MODEL 610B

SWEPT FREQUENCY GENERATOR

INSTRUCTION MANUAL

With 6108 Plug-In
and 61HH

MP MASTER
MA34181

HEWLETT-PACKARD COMPANY
PALO ALTO, CALIFORNIA

MODEL 610B

SWEPT FREQUENCY GENERATOR

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WILTRON COMPANY
for better electronics measurements

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TABLE OF CONTENTS

GENERAL INFORMATION (TECHNICAL DATA SHEET) SECTION 1

FUNCTIONS OF CONTROLS SECTION 2

MEASUREMENT PROCEDURE SECTION 3

REMOTE PROGRAMMING OF FREQUENCY AND SWEEP SECTION 4

OPEN SECTION SECTION 5

THEORY OF OPERATION SECTION 6

6-1 GENERAL
6-2 SWEEP GENERATOR
6-3 FREQUENCY INSTRUCTION
6-4 FREQUENCY CONTROL
6-5 OUTPUT LEVELING
6-6 INTERNAL DETECTOR
6-7 MARKERS
6-8 POWER SUPPLIES

RECALIBRATION PROCEDURE SECTION 7

7-1 SETTING OF THE 610B FRONT PANEL CONTROLS
7-2 POWER SUPPLY RECALIBRATION
7-3 SWEEP GENERATOR RECALIBRATION
7-4 SWEEP DRIVER RECALIBRATION
7-5 FREQUENCY INSTRUCTION RECALIBRATION
7-6 VARIABLE FREQUENCY MARKER RECALIBRATION
7-7 LEVEL CONTROL RECALIBRATION
7-8 HARMONIC MARKER RECALIBRATION
7-9 POWER SUPPLY ADJUSTMENTS
7-10 VARIABLE FREQUENCY MARKER ADJUSTMENTS
7-11 SWEEP GENERATOR ADJUSTMENTS
7-12 EXT TRIG and HOLD OFF ADJUSTMENTS
7-13 SWEEP DRIVE ADJUSTMENTS
7-14 MECHANICAL ADJUSTMENT OF DIAL POINTERS
7-15 FREQUENCY INSTRUCTION ADJUSTMENT
7-16 HARMONIC MARKER GENERATOR ADJUSTMENT
7-17 MODEL 610B TROUBLE SHOOTING CHART
7-18 REQUIRED TEST EQUIPMENT

PARTS LIST SECTION 8

SCHEMATICS and FLOW DIAGRAM SECTION 9

INSTRUCTION MANUALS ON PLUG-INS

FREQUENCY CONTROL, F1

This upper left hand knob sets the start frequency anywhere over the calibrated range of operation of the plug-in.

FREQUENCY CONTROL, F2

An upper right hand knob sets the stop frequency anywhere in the calibrated range of operation of the plug-in. F2 can be set at a higher frequency than F1 for sweeping upward in frequency or at a lower frequency than F1 for sweeping downward in frequency.

VARIABLE MARKER

Between F1 and F2, the marker control sets the frequency of the mark during sweep operation and is the center of the ΔF sweep during the ΔF mode of operation.

FREQUENCY SELECTOR

The major black knob control has six positions whose functions are listed below.

REMOTE. The frequency output is completely determined by the voltage applied on the remote frequency programing at the rear.

F1 TO F2. Frequency sweep between the limits programed by the knobs F1 and F2.

ΔF SWEEP Plus and minus around the variable marker frequency.

CW F1. A fixed frequency non-swept signal selected by the F1 control.

CW MARKER. A fixed frequency non-swept signal selected by the VAR. FREQ. MARKER control.

CW F2. A fixed frequency non-swept signal selected by the F2 control.

The inner red control of the FREQ. SELECTOR switch has two positions for RETRACE RF, ON or OFF. In the 'ON' position the R.F. signal remains on between sweeps. In the RETRACE 'OFF' position the R.F. stays off between sweeps.

ΔF FREQUENCY

The ΔF control sets a calibrated sweep of from 0 to 5% about a center frequency selected by the VAR. FREQ. MARKER control. For example, when set to "2" the frequency sweep would be ±1% of the total frequency spanned by the plug-in frequency range.

SWEEP MODE

This switch selects the manner in which the sweep is initiated. The four positions of the main outer control are listed below.

TRIG. A panel push button initiates a sweep so as to provide single sweep capability.

MANUAL. In this position there is no sweep and the frequency can be manually tuned by the inner red knob.

The inner red control is used to manually tune the frequency when the outer black knob is set at manual. This control will manually tune over the frequency range set by the F1 TO F2 CONTROL or by the ΔF FREQUENCY. During this manual tuning a horizontal output is supplied proportional to the percent of frequency excursion.

LINE SYNC. The switch for syncing at the 60 cycle line frequency. This is often useful in examining hum effects or other effects that are believed to be related to line frequency.

AUTO. The sweeps recur with a minimum delay between sweeps.

Functions of Controls - cont'd

SWEEP TIME (SEC)

The outer black control sets the range of sweep times to one of four ranges covering from 100 seconds per sweep to .01 seconds per sweep. The inner red knob selects the exact sweep desired in the 10:1 range. For example when the black knob is in the 100 - 10 position, the red knob provides a sweep greater than 100 seconds in its most counterclockwise position and a 10 second sweep duration in its most clockwise position.

FROM EXT. DETECTOR

This input provides the means of mixing the marker pips with the signal from an external detector and supplying their combined total to the VERT. OUT jack.

RF IN TO DETECTOR

This input goes into a crystal detector which can be used to detect the R.F. test signal out of the device under test. The output from this detector is on the VERT. OUT jack adjacent.

VERT. OUT

The VERT. OUT jack supplies the output from the built-in detector. This output is normally applied to the vertical axis of an oscilloscope or XY recorder.

HORIZ. OUT

The HORIZ. OUT provides the sweep voltage output of 0 to app. 10 volts sawtooth during F1 TO F2, ΔF, and MANUAL SWEEP MODES. 0 to approximately 10 v d.c. signal depending upon the frequency setting when operating at single frequency on F1 or F2. Output impedance is 10 K ohms.

MODULATION

NORMAL. The NORMAL position levels the R.F. output and permits no internal or external modulation.

INT. AM. The INTERNAL AM position actuates a built-in 1000 Hz amplitude modulation.

EXT AM. The internal leveling stays in operation and amplitude modulation is conducted by the input signal at the EXT. input BNC connector.

1 kHz FREQ. ADJ. Screwdriver control varies internal modulation frequency ±10% around 1 kHz.

EXT. FM. In the EXT. FM position the internal leveling remains on and the frequency is frequency modulated in accordance with the signal applied at the EXT. BNC connector. The input FM signal is internally coupled through approximately 0.1 microfarads capacitance. The input resistance is approximately 50 K ohms. The FM sensitivity is approximately 10 MHz per volt. The frequency response of the internal amplifier is approximately 30 Hz to 200 kHz. For external FM to be operative from this control the FREQ. SELECTOR switch must be in some position other than REMOTE. In the REMOTE position the frequency modulation would need to be conducted in conjunction with the frequency programing at the rear input terminals.

Function of Controls contd.

MODULATION continued

EXT. LEVELING. When the MODULATION control is in the EXT. LEVELING position the EXT. LEVELING sensitivity is adjustable by means of a screwdriver control directly above the EXT. LEVEL position. When the leveling is not being accomplished over the whole frequency band the unleveled light will come on. External leveling can be supplied by the user at the EXT. input BNC next to the LEVELING sensitivity control. A -100mv signal into 10 K ohms is a typical leveling input signal.

FREQUENCY MARKERS

A series of six toggle switches control the frequency markers. Each marker position can be separately turned on and off.

BIRDIE MARKERS AMPLITUDE

This control adjusts the amplitude of all birdie markers internal and external.

EXT. R. F. MARKER INPUT

An R.F. signal introduced on this BNC connector provides a frequency marker at the input frequency.

VAR. FREQ. MARKER AMP.

The inner red control adjusts the amplitude or intensity of the RF marker. The outer black control selects the type of marker, RF PIP (which achieves a notch marker by turning the RF off), VIDEO (which mixes pulse in video and does not disturb RF), and the INTENSITY (which causes an intensity mark on the output display scope.)

REAR TERMINAL CONNECTORS

110/220 VOLT SWITCH. Selects the line voltage to be used, 110 volts or 220 volts.

FUSE. 0.8 Amp. Slo-Blo, replaceable at rear next to power cord.

TRIGGER IN. Sweep can be triggered by +1 volt signal with greater than 1 μs pulse width and greater than 0.1 volt/μsec rise.

BLANKING. Output of +30 v during retrace. Near ground during sweep.

REMOTE FREQ. Terminal A has positive 10 volts output. Terminal D is grounded. Terminal B is the input which controls frequency. Zero volts on terminal B gives the lowest frequency of the plug-in range. Plus 10 volts gives the highest frequency of the plug-in range. Other terminations are made use of for external programing.

VERT. OUT. Optional BNC connectors can provide output from the built-in detector. This rear terminal is in parallel with the front panel connector.

HORIZ. OUT. Optional BNC connectors provide 10 volt sawtooth during sweep. The rear terminal is in parallel with front panel connector.

EXT. INPUT. EXT. INPUT is an optional BNC connector for applying AM or FM or EXT leveling depending on the position of front panel MODULATION switch. In parallel with front panel connector.

Function of Controls contd.

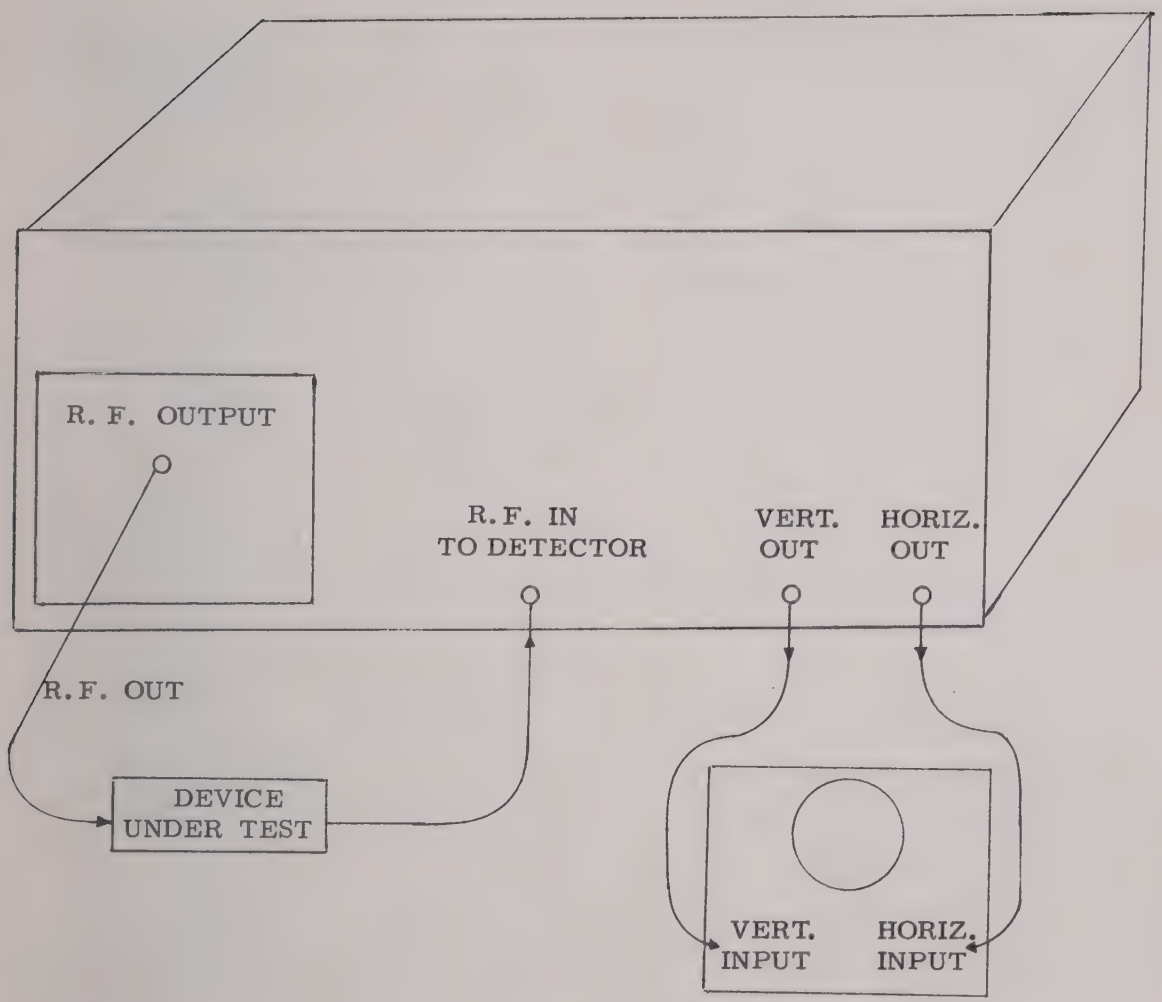
REAR TERMINAL CONNECTORS contd.

VARIABLE MARKER OUT. Optional output BNC provides a pulse out coincident in time with the variable marker.

PEN LIFT CONTACTS. Optional output provides contact closure during retrace to be used in lifting the pen of an XY recorder.

SECTION 3 MEASUREMENT PROCEDURE

Typical Measurement Setup for
Plotting the Amplitude Response vs Frequency
of a device under test



HOW TO PLOT FREQUENCY RESPONSE

The below step-by-step procedure is used for plotting the amplitude response of a device under test as a function of frequency.

1. Plug in power cord to 50-60 Hz, 115 v outlet. (Slider switch on the rear converts the transformer to 230 volt operation.) Turn on the instrument by use of front panel switch. Allow 30 minutes for the instrument to temperature stabilize prior to setting the frequency sweep limits.
2. Set MODULATION switch to NORMAL.
3. Set FREQ. SELECTOR to F1 TO F2.
4. Set F1 to the desired lower test frequency; set F2 to the desired upper test frequency.
5. Set SWEEP MODE switch to AUTO.
6. Set SWEEP TIME switch in the 10-1 range; turn SWEEP TIME VERNIER fully clockwise.
7. Connect output of test device to RF IN, TO DETECTOR connector. Connect VERT. OUT to vertical input of d.c. coupled oscilloscope. Connect HORIZ. OUT to horizontal input of d.c. coupled oscilloscope.
8. Actuate desired frequency markers by switching on their toggle switches.
9. Select desired test signal level by the RF POWER LEVEL controls on the plug-in panel. The maximum output is +13 dbm which equals 1 volt rms output into 50 ohms.
10. Connect RF OUTPUT of sweeper to input port of the device under test. Observe the output response on the oscilloscope.

VARIATIONS IN USE OF SWEEPER

A. When external FM is desired, put the MODULATION switch in the EXT. FM position and apply frequency modulation to the EXT. INPUT.

B. When external AM is desired, put the MODULATION switch in the EXT. AM position and apply the amplitude modulation to the EXT. INPUT.

C. When external leveling is desired, put the MODULATION CONTROL in the EXT. LEVEL position and apply a negative leveling voltage to the EXT. INPUT. Use a screw driver to adjust the EXT. LEVEL CONTROL for the proper leveled output. The UNLEVELED light will come on if the signal is not leveled across the whole frequency band being used.

D. When maximum signal level is desired at the sacrifice of leveling, switch to EXT. LEVEL position and do not apply any EXT. INPUT.

E. When it is desired to sweep around a center frequency, set the FREQ. SELECTOR to ΔF F1, set F1 to the desired center frequency, set ΔF FREQUENCY to the total ΔF frequency to be swept.

F. For use with an XY recorder, set the SWEEP TIME control to 100-10 and the VERNIER to mid range: set the SWEEP MODE switch to TRIG. Push the TRIG button when it is desired to actuate a sweep.

G. For external frequency programing, set the FREQ. SELECTOR to REMOTE and set the output frequency by one of the following two methods:

   1. Connect the voltage output from terminals 3 and 1 to the terminals

Variations in Use of Sweeper - cont'd.

of a potentiometer. Connect the resultant voltage output from the center top of the potentiometer to terminal 2 which sets the frequency. Note: Terminals 1, 2 and 3 are located on the rear chassis marked REMOTE FREQUENCY.

2. Connect a voltage waveform of from +1 to +10 volts between input (terminal 2) and ground (terminal 3). See Section 4 for complete directions.

SECTION 4 REMOTE FREQUENCY CONTROL and PROGRAMMING

The Model 610B has provision, via terminal strip J103 on the rear of the instrument, for two types of frequency control.

Terminal B provides direct coupled frequency control with about 1 Megohm input impedance. This input is uncoupled from terminal C and used when a voltage controlled signal source is desired; e.g., for phase lock, for remote control of frequency, or for injection of an external sweep.

The control relation is 0 to +10 volts relating to 0 to 100% of the frequency range of the plug-in being operated. Thus the Model 6104 100 MHz Plug-In has a control relation of 10 MHz per volt. In remote situations, well shielded leads and minimum ground loops are required to prevent FM.

For resistance control an internal d.c. voltage is provided at terminal A which provides 10.0 volts ±1% when loaded with 10 K ohms. For continuous control a 10 K pot. may be connected as shown in Figure 1(a). For stability and accuracy, a precision wire wound pot. with good linearity should be used.

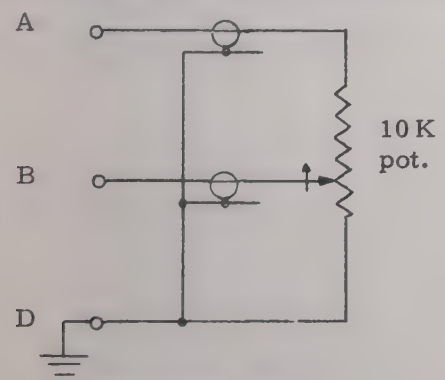
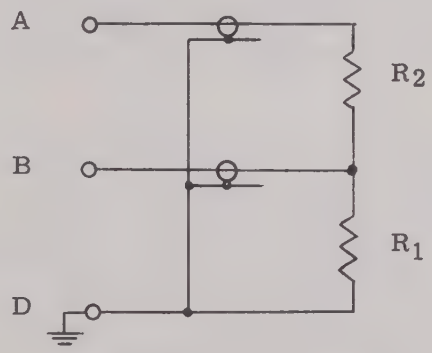


FIGURE 1(a)

By using a standard 10 turn pot. with the dial calibrated in decimal units the frequency will be direct reading for the Model 6104 Plug-In. A specific frequency can be established with fixed resistors as shown in Figure 1(b). For accuracy and stability, precision metal film or wirewound resistors should be used. Similarly, additional tap points along the 10 K total resistance and a selector switch connected to terminal B will provide multiple preset frequencies.



R_1 = F x 10 K ohms

R_2 = 10 K - R_1

where F is the desired frequency expressed in % of plug-in band.

FIGURE 1(b)

The other frequency control connection permits external programming of the Frequency Control circuit so that different frequency spans (up to 100% of the available band) and center frequencies may be established remotely. The internal sweep is used and two separate controls establish the center frequency, f_c, and the total frequency span, Δf. These controls function the same as the panel controls VARIABLE FREQUENCY MARKER and ΔF except that Δf is extended to permit a 100% sweep. Terminals B and C must be linked.

Remote Freq. Control... cont'd.

Both controls are linear so that full travel of each pot. relates to 100% of the frequency range of the plug-in being operated. The connections are shown in Figure 2 and the indicated resistance values of 50 K and 2 K must be observed for best performance.

The WILTRON Model 6111 Frequency Programmer provides 10 swept frequency programs selectable with a front panel switch. The unit connects to the rear of the Model 610B and each program is preset by the user to the desired frequency range.

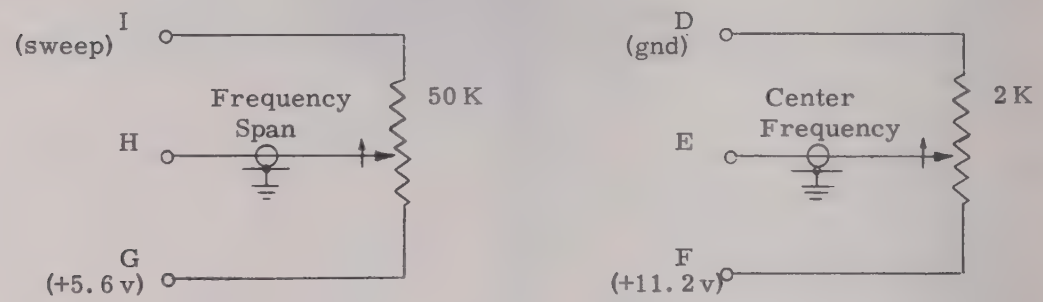


FIGURE 2

 (Pages 15 and 16 are blank)

6-1 GENERAL

The WILTRON Model 610B is a master support unit for various plug-in Frequency Generating Units. It supplies a standardized control voltage for setting frequency with calibrated sweep rates; level regulating circuits for maintaining a uniform output power level; modulation circuits; detection and frequency marker circuits; and stable regulated power supplies. Because of the broad frequency coverage of the various plug-ins different methods of frequency generation and level control are used. The following theory of operation describes generalized characteristics of the plug-ins with specific refinements referred to in the Theory of Operation Section for each plug-in.

6-2 SWEEP GENERATOR

The basic elements of the SWEEP GENERATOR are shown in Fig. 6A. The Miller Integrator consists of the amplifier Q104, Q105, Q106, the feedback capacitor C_T, and the charging current i_t set by R_T and -E. The Integrator is controlled by the state of the Schmitt Trigger via CR105 and R116. The output of the integrator is attenuated and voltage offset by the resistive divider and coupled through Q107 and R108 to the Schmitt Trigger input.

A sweep is initiated when Q103 turns on and opens CR105. The current i_t must now be supplied by C_T and a voltage linearly increasing with time begins developing across C_T. The high gain amplifier Q104, Q105, Q106 provides this same voltage so that the input to the amplifier remains essentially constant in voltage level. The charging current i_t is then constant and the voltage at the output of the amplifier is a linear ramp with time.

Sweep Generator- cont'd.

The ramp continues until the portion of it coupled back to the input of the Schmitt Trigger reaches the upper hysterysis level (UHL) and causes a change of state. With Q103 off, CR105 closes and R116 provides a current of about seven times i_t. The integrating process now reverses and C_T charges negatively (in a linear manner) at about six times its charge rate. This continues until CR104 closes and drains the current excess above i_t. This causes the output to cease movement and establishes a stable starting level for each sweep.

Fig. 6B shows the generated sweep voltage and the emitter voltage of Q107 which controls the Schmitt Trigger. This timing waveform shows how the emitter of Q107 is picked up at t_2, carried up with the ramp until it reaches the UHL causing the ramp to reverse at t_3, and falls along the slower time constant of R_{Ho} C_{Ho} until the LHL is crossed at t_5 causing another sweep to initiate.

By raising the clamp voltage on CR106 the emitter of Q107 can be prevented from reaching the LHL and the sweep cycle will cease and wait. This is the triggered mode and the waveform is shown in Fig. 6C. Refer to the full schematic 610B-100. Q101A and Q101B form a Schmitt Trigger which gives a uniform output for all input signals exceeding 1 volt. C103 differentiates this into a trigger pulse and CR102 and CR103 couple only the negative trigger through C104 to the input of Q102. If the sweep is in a recovered state the trigger will cross the LHL and initiate a sweep cycle, eg t_1, and t_5 in Fig. 6C. Manual triggering is accomplished with S103 which discharges the hold-off capacitor when pressed.

Sweep Generator - cont'd.

Upon release the discharged capacitor pulls the emitter of Q107 negative causing the LHL to be crossed and the sweep to start.

Transistors Q108 and Q109 are on during the sweep and off otherwise giving at J102 a voltage near zero during the sweep and +30 volts otherwise. This can be used for timing or blanking other equipment synchronous with the sweep. The voltage from Q111 is +28 volts during the sweep, near zero volts otherwise and is used to deactivate both the RF source and the level loop during the blanking period.

The Sweep Vernier, R134, is normally returned to about -18 volts and reduces the sweep rate by at least 10 to 1 as the voltage is reduced. The Field Effect Transistor, Q104, provides a very high input impedance so that slow sweeps can be achieved with reasonable sized capacitors. The Sweep Bias Adjustment, R126, corrects for the FET bias so that with zero volts on the sweep vernier the ramp will continue to move forward at a very slow rate. This permits intensification of an oscilloscope display by causing the spot to dwell for a period. The Variable Marker circuit, schematic 610B-300, provides the sweep vernier voltage and drops it to -5.0 when intensification is required.

In MANUAL SWEEP mode, R144 provides the sweeping voltage to following circuits and S101B2 forces both Q102 and Q103 to be off. This keeps the integrator at its starting point and sets all blanking outputs as if the sweep were on.

6-3 FREQUENCY INSTRUCTION

The sweep voltage from S101 is clamped between two reference voltages for the purpose of establishing accurately the levels traversed by the sweep and to create a short dwell period at each end for the circuits to respond to the blanking signals. See Fig. 6D. The upper end is clamped to the +11.2 supply voltage and the lower end to a voltage equal to the forward drops of CR202 and Q201. Each clamp voltage is adjustable and temperature compensated so that the output of Q201 can be set to traverse from zero to the voltage of the +11.2 supply which is within 5% of the stated value.

The truncated sweep voltage is attenuated to 0 to 10 volts and supplied as the Horizontal Output. It also drive the two potentiometers for setting F1 and F2. The current variations on the +11.2 volt supply caused by the sweep are cancelled by the action of Q202 which provides an equal and opposite variation. Since the 11.2 volt supply is the reference for both +30 and -20 this sweep ripple correction is apparent on all supplies.

Fig. 6D shows the connections between the frequency controls and the differential amplifier Q203, 4, 5 for F1 to F2 operation. The transistors Q204 and 5 are current sources for the amplifier. The amplifier output is 0 to +10 volts for a 0 to 100% of dial frequency sweep. The output can be represented as $10[x+(y-x)F_{(t)}]$ where x and y are the percent of full dial settings of F1 and F2 respectively and $F_{(t)}$ represents a 0 to 1 linear sweep function. The diagrams of Fig. 6E show the operation of this differential amplifier graphically. Note that if F1 is set above F2 the circuit functions as before and the output travels from the higher to lower value.

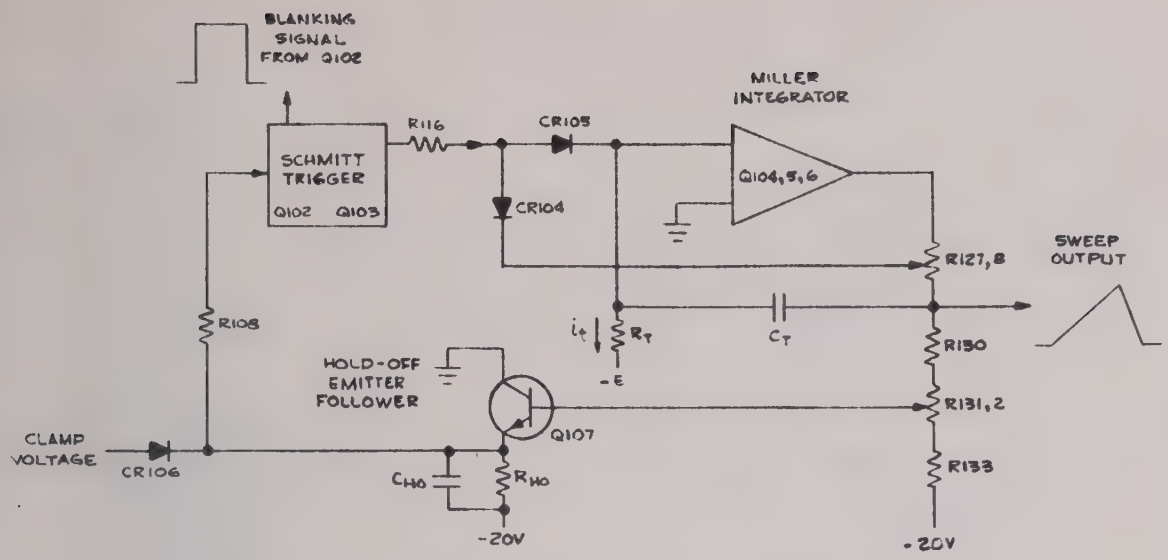


Figure 6A

BASIC ELEMENTS OF THE SWEEP GENERATOR

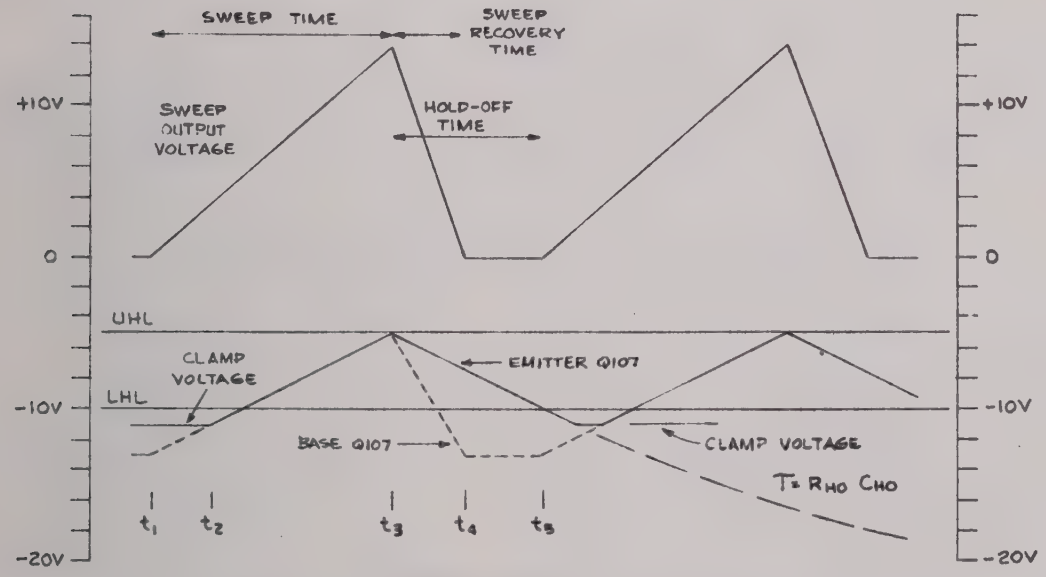


Figure 6B

FREE RUNNING SWEEP WAVEFORMS

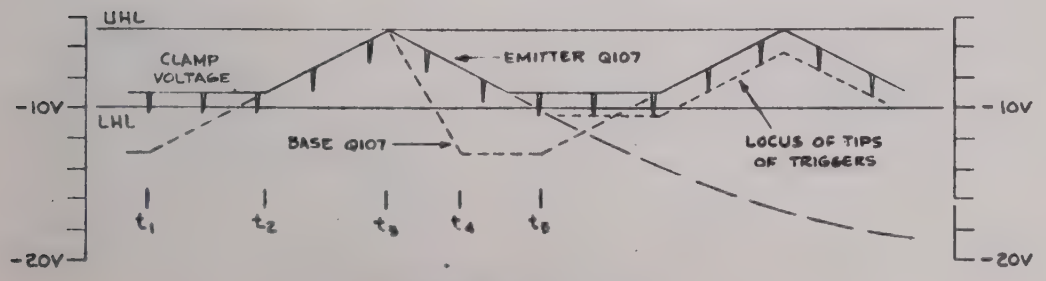


Figure 6C

TRIGGERED SWEEP WAVEFORMS

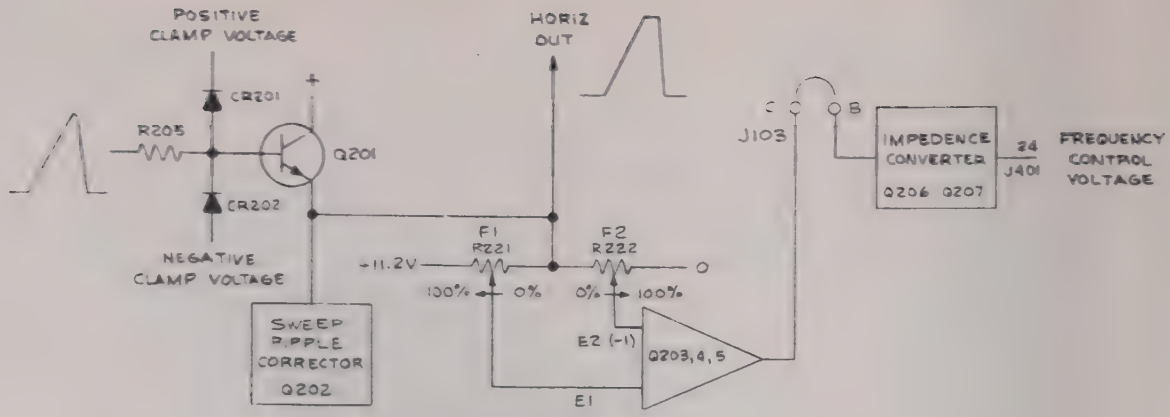


Figure 6D

FREQUENCY INSTRUCTION BASIC CIRCUIT

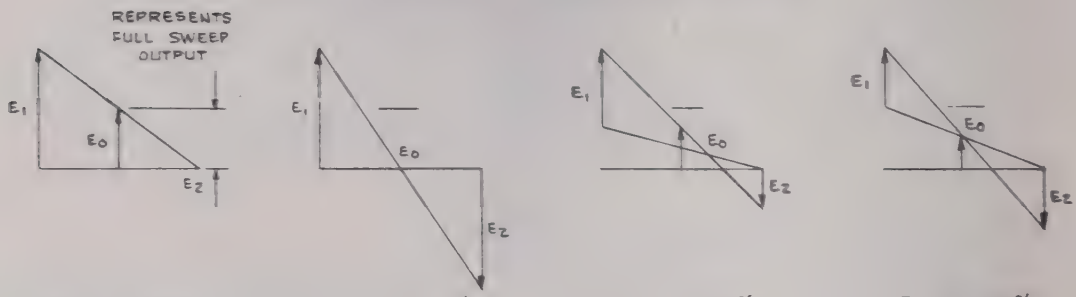


Figure 6E

FREQUENCY INSTRUCTION SUMMING DIAGRAMS

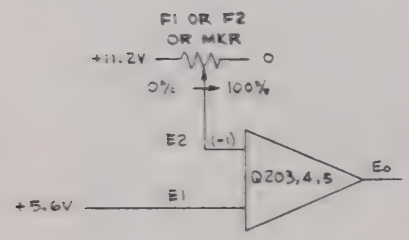


Figure 6F-1

FREQUENCY INSTRUCTION
CW OPERATION

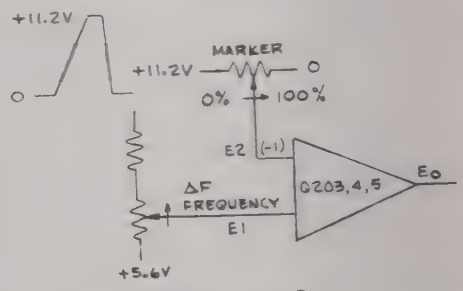


Figure 6F-2

FREQUENCY INSTRUCTION
ΔF OPERATION

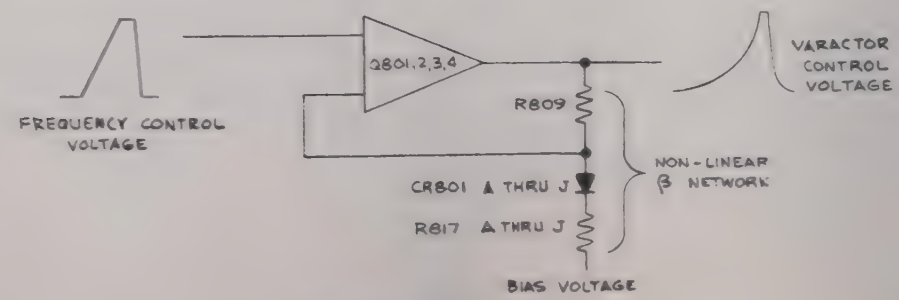


Figure 6G

FREQUENCY CONTROL BASIC CIRCUIT

Frequency Instruction - cont'd.

CW operation is similar with the appropriate Frequency Control providing a voltage proportional to the dial setting for one input and +5.6 (one-half of the 11.2 volt supply) connected to the other input. The Selector switch, S2-1B2, changes the two current sources, Q204 and Q205, to correct for a 5 volt offset in the output voltage which would otherwise occur. Figure 6F1 shows the CW connection and Fig. 6F2 shows the ΔF operation. ΔF functions the same as CW except that the +5.6 voltage is caused to sweep equal amounts above and below in proportion to the ΔF Frequency control setting. The calibration is in percent of full dial.

The Remote position of the Frequency Selector Switch connects the circuit for ΔF operation with connections to the rear terminal strip J103 where two potentiometers may be connected. See section
These controls function the same as the panel controls ΔF Frequency and Marker; however, ΔF can now be set for any sweep span up to the full capability of the plug-in use.

The 0 to 10 volt output of the Frequency Instruction circuit is wired to Terminal C of J103, back in term B and through the Impedance Converter Q206, 207. This circuit is adjusted for no voltage offset and has 98% transmission. This voltage feeds the Frequency Control circuits of the Plug-in and the Variable Frequency Marker circuit. The link is removable from terminal B of J103 so that an external voltage may be introduced for remote control frequency. Resistance control may also be used by using Terminal A. A 10K potentiometer connected from A to ground will have 10 volts across it and with its slider connected to terminal B will have direct frequency proportional to the potentiometer setting. A 1K value may be used by opening R219.

FM is obtained by coupling the external ac signal through C202 and R217 to the Frequency Control signal. Since the output frequency is directly proportional to this voltage the FM deviation will be essentially constant across the full band of the plug-in. When using Ext. FM together with remote frequency control on terminal B the impedance connected to terminal B should be raised to near 50K ohms by adding a series resistor to aid the coupling of low frequency FM signals.

6-4 FREQUENCY CONTROL

This section is a generalized discussion of the shaping circuit used with the varactor tuned oscillators. The theory of Operation section for the particular Plug-in will note any deviations. See Figure 6G for the basic circuit configuration.

The linear control voltage is fed to one input of the operational amplifier formed by Q803, 4, 1 and 2. The ouput is attenuated and fed to the other input. This negative feedback causes the gain of the amplifier to be the inverse of the attenuator characteristic. The attenuator is made non-linear by means of (typically) ten diodes each biased at a voltage between 0 and +10 volts. As the control voltage reaches each of the bias levels the corresponding diode starts to conduct lowering the impedance level of the lower part of the attenuator. Thus the output voltage changes to a steeper slope until the next diode closes. The resultant output voltage is composed of eleven straight line segments that very closely synthesize the non-linear varactor tuning voltage. The different bias voltages for the shaping diodes set the frequency where bending commences and the series resistance, R817, establishes the slope.
The ten resistances of R817 are selected for the particular oscillator in the plug-in.

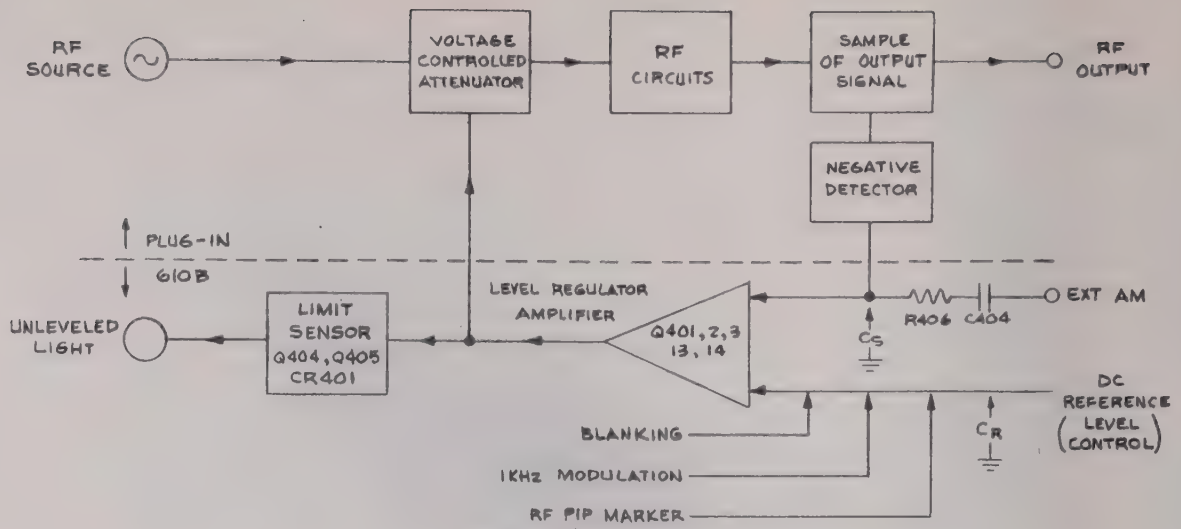


Figure 6H

LEVEL CONTROL BASIC CIRCUITS

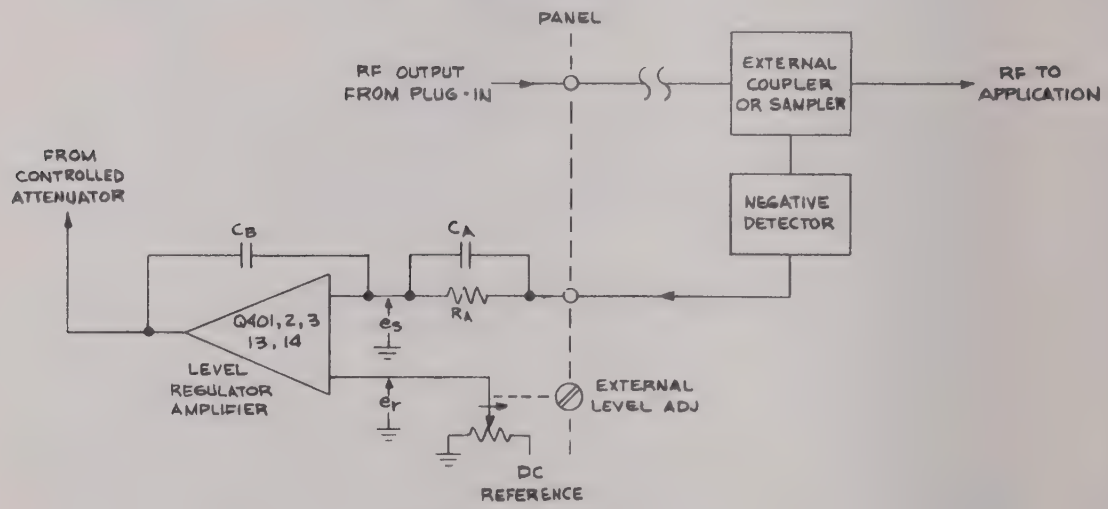


Figure 6I

EXTERNAL LEVELING BASIC CIRCUITS

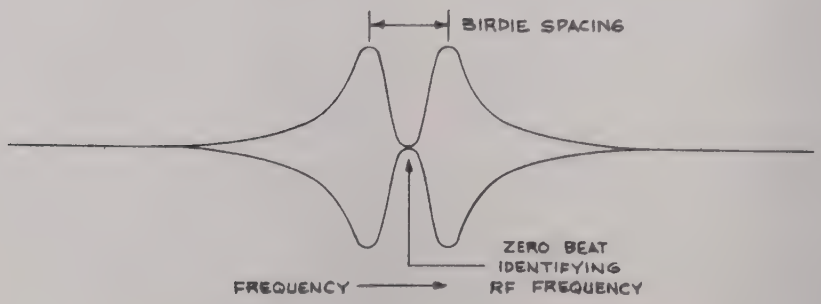


Figure 6J

BIRDIE MARKER ENVELOPE

6-5 OUTPUT LEVELING

The output signal is maintained level by monitoring and using electrical feedback to a voltage controlled attenuator. This same circuit is used to apply amplitude modulation to the signal.

The basic circuit configuration is shown in Fig. 6H. A fraction of the output signal is taken by the sampler which in many plug-ins is a coupler. This signal is converted to negative dc voltage e_s with a flat frequency response detector. A high gain operational amplifier compares e_s with a reference voltage e_r and delivers a suitable drive to the voltage controlled attenuator to make e_s equal e_r. With this control loop operating the output signal will be as flat as the characteristics of the sampler and the detector.

External amplitude modulation is accomplished by summing the modulation signal with the detector output to provide e_s. The inverted modulation signal is imposed upon the R. F. signal so that the sum of the detected R. F. plus the modulation signal equals e_r. It is apparent that sine wave modulation requires increased output at the peaks so that e_r, established by the Level Control, must be reduced to stay within the power output rating of the plug-in.

Internal modulation is accomplished with the 1 kHz square wave applied to e_r causing the detected R. F. to follow the instantaneous value of e_r. The 1 kHz oscillator is a free-running multivibrator, Q406 and Q407, with the output taken through CR404. The pulse from the variable frequency marker is also applied to e_r to cause a momentary dip in the R. F. level.

Output Leveling - cont'd.

When the RETRACE R. F. is turned off the blanking + signal pulls e_r to ground potential or slightly positive so that the voltage controlled attenuator is held in a high attenuation state during the retrace time when the R. F. signal is absent.

Whenever level control cannot be maintained the feedback loop will force the output of the amplifier to either its positive or negative extreme. At its positive limit (about +1.5 volts) CR401 conducts and Q405 activates the Unleveled Light. At the negative limit (about -18 volts) Q404 is turned off and the light is powered. The blanking-signal is used to deactivate Q405 when the Retrace RF is off.

External leveling connections are shown in Fig. 6I. The elements $C_A R_A$ and C_B control the loop response to maintain stability and are a part of the plug-in. With crystal leveling a negative detector must be used. The External Level screwdriver adjust varies the dc reference to mate to the sensitivity of the external detector and acts as a level control. Detector voltages below 50 mv will give leveling but large larger voltages will give flatter performance because of higher loop gain. In the Power Meter position of the Modulation selector a 1K resistor is provided across the input terminal to satisfy the load requirement of a typical power meter. In addition the stabilizing network is changed to accommodate the very slow response time of the power meter.

6-6 INTERNAL DETECTOR

Schematic 610B-300 shows the internal detector composed of CR308, R313 and

* In addition, the 1 kHz square wave and the Blanking - signal are applied directly to the RF source to insure 100% AM modulation on INT AM and zero RF output during blanked retrace.

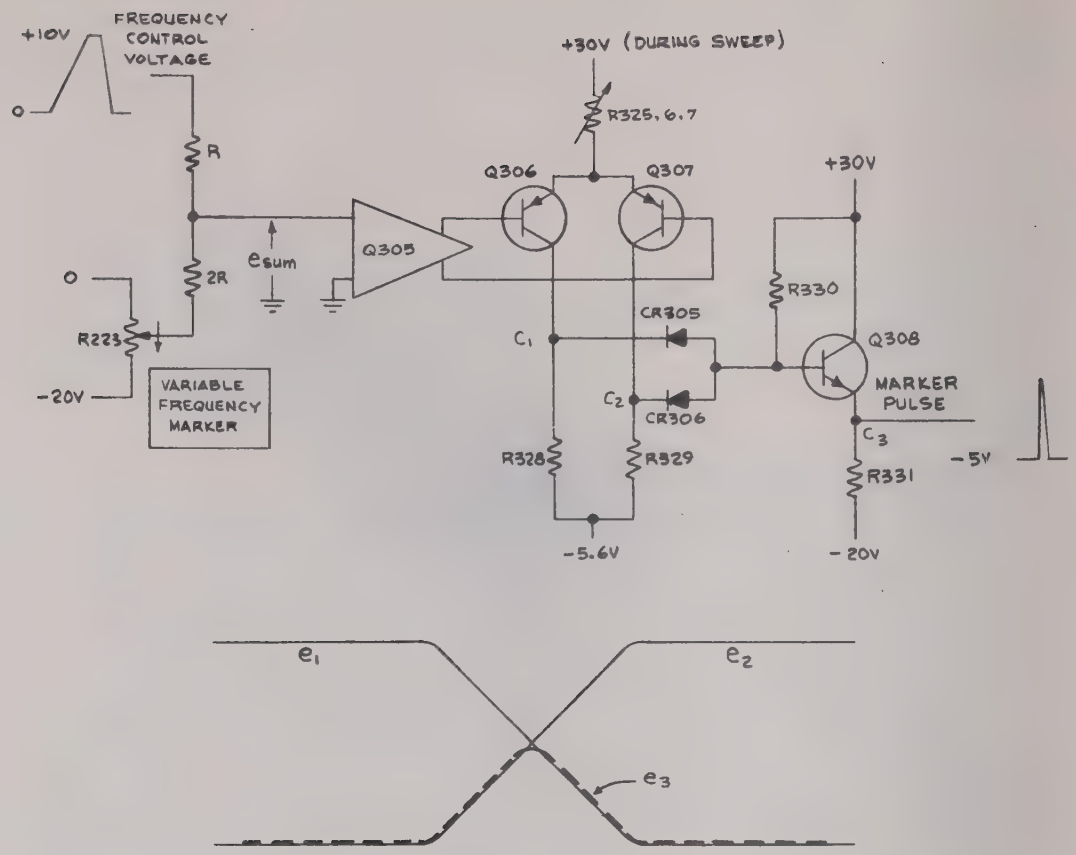


Figure 6K

VARIABLE MARKER COMPARATOR and PULSE SHAPER

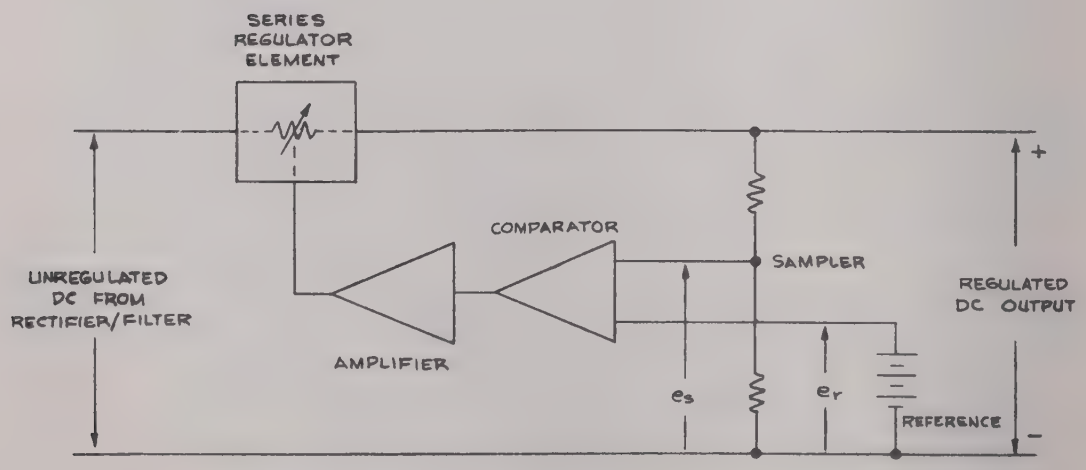


Figure 6L

BASIC POWER SUPPLY REGULATOR

Internal Detector - cont'd.

C310. The circuit is in a configuration which holds the flatness, VSWR and sensitivity good from 50 KH_Z to over GH_Z. The output of the detector is coupled through R315 to the Vertical Output jack. Provision is made for coupling the output of an external detector to the same jack.

6-7 MARKERS

Two marker systems are a part of the Model 610B; the Birdie Markers and the Variable Frequency Marker. The characteristic double peaked response of the birdie marker, see Fig. 6J, is coupled to the Vertical Output jack for display on the detected R. F. During retrace time Q304 shorts out the birdie signal to provide a clean base line. See Schematic 610B-300. The Variable Frequency marker (VFM) provides an identifying mark on the display for a dial setting. The output of the VFM is a positive going pulse which is coupled through the amplifier Q303 to place a narrow negative notch on the detector output when the VFM switch is in the Video position. In the R. F. Pip position the pulse is coupled through CR307 to momentarily drop the level reference voltage causing the R. F. output to dip. In the intensity position the display is brightening of the oscilloscope trace by the amplifier Q309 and 310 acting to slow the sweep progress momentarily thus permitting the electron beam to dwell and produce a brighter spot. This intensification is also present when the R. F. Pip and Video positions are used.

The Variable Frequency Marker functions with all plug-ins using the basic circuit as shown in Fig. 6K. The resistors R and 2R sum two voltages of opposite polarity, the frequency control voltage and a dc voltage proportional to the marker dial setting. The sum, e_S is zero when the Frequency Control voltage corresponds to the marker setting. The comparitor Q305 is a stable hi-gain linear amplifier which is followed by a differential amplifier Q306, 307. As the sweeping Frequency Control voltage causes e sum to cross zero the current in the differential amplifier makes a linear transition from Q306 to Q307. The collector voltage e_2, shown in Fig. 6K moves from -5.6 to a more positive value set by R329 and R325, 6, 7. The voltage e_1 simultaneously makes the opposite transition. The diode logic of CR304 and 306 couples the more negative of the two waveforms to the emitter follower, Q308, which thus shapes the variable marker pulse. By changing the available current with R326 the magnitude of the pulse is controlled. The high gain employed produces a very narrow marker only 0.4% of the dial width at its base for full amplitude and becomes more narrow with reduced amplitude.

Control of the sweep rate by the marker for instensity display is accomplished with Q309 and 310. These transistors form an amplifier with dc offset which provides the voltage for the Sweep Vernier control. The normal level is -18 volts which drops to -0.5 during the marker when the amplitude is at maximum. This reduces the sweep charging current causing the sweep to slow as the marker shape is generated.

The birdie markers are derived from the mixer shown on schematic 610B-001. All the plug-ins have internal provision for feeding a part of the output R. F. to this mixer to provide birdie markers. This internal R. F. is mixed with R. F. from up to seven single frequency oscillators, a harmonic train of R. F. frequencies or external R. F. applied at the front panel. The diode CR11 provides the non-linear mixing action and the beat frequency is brought out through the filter C11 and R32.

Markers - cont'd.

The beat frequency is enlarged and shaped by the tuned amplifier Q301, schematic 610B-300, to give the typical birdie shape shown in Fig. 6J. This amplifier is single tuned giving a response peak at its center frequency. The biridie has two peaks since it crosses the amplifier response twice; as the sweeping R. F. approaches the marker from below and again as it passes beyond. The spacing between peaks is 14 KH_Z in the Narrow position and 200 KH_Z in the Wide. The tuned circuitL302 and C304 sets the wide response. In narrow operation the tuned circuit L301, C303 and R308 is followed by a filter section R356 and C304 to make the birdie fall off faster with frequency, giving a more narrow response than a single tuned circuit. An untuned amplifier Q302 gives further magnitude which is controlled for display with the Marker Amplitude attenuator, R311.

Two marker widths are provided for usage with both wide and narrow sweeps. The wide marker should always be used when sweep width permits because it receives greater energy and typically produces a larger marker. The markers will improve in appearance when slower or narrower sweeps are used because the transition rate in MH_Z/sec through the birdie amplifier spectrum is reduced permitting the birdie envelope to contain more cycles of beat frequency energy.

The Harmonic Marker Generator accessory which fits into the 610B frame contains four crystal oscillators which are coupled through two buffer amplifiers to a step recovery diode. Only one oscillator is biased on the dc current which is overcome with the R. F. drive signal. During the reverse bias period the diode continues to conduct as the stored charge is swept out.

This reverse current suddenly drops to zero because of the particular doping of the junction, creating a sharp voltage step which is rich in harmonics of the R. F. drive signal. The diode voltage is coupled to the output 50 ohm coax. The generator that provides the fundamental frequency is a 1 MHz crystal oscillator. The multivibrator provides the necessary rapid drive signal for the step-recovery diode.

The SINGLE FREQUENCY MARKER unit consists of a crystal oscillator and an emitter follower. The output is lightly coupled to a 50 ohm coaxial line which passes through the unit. Successive units are connected in series with a 50 ohm termination on the last and the first connected to the birdie mixer.

6-8 POWER SUPPLIES

The two primary supplies are +30 and -20 volt and are designed for low ripple and high stability in the presence of temperature variations. Both supplies are fed by a bridge rectifier with a capacitor filter and follow the basic regulator circuit shown in Fig. 6L. The output voltage is sampled by a resistive voltage divider and is compared to a voltage reference. A differential amplifier is used for a comparitor so that temperature effects are cancelled. Any difference voltage between e_s and e_r is sensed by the comparitor and amplified. Another amplifier provides further gain to drive the series regulator element which completes the feedback loop. The series element changes its conductance until e_s is equal to e_r. Note that the negative output terminal may be grounded to make a positive supply or the positive supply or the positive terminal grounded for a negative output. Also e_s and e_r may be referenced to the positive lead with the amplifier output phase inverted to retain the negative feedback.

Power Supplies - cont'd

The +30V supply obtains its sample with R510 and R513 which is compared by Q506 to the reference +11.2V Super Regulated Power Supply. The amplifier, Q503 and 504, provides high gain for tight regulation and C508, R514 provide frequency compensation to maintain the loop stable. The driver transistor Q502 provides the current gain for controlling Q501 the series regulator transistor.

Current limiting to protect against short circuit overload is provided by R503, 504, and 508. When shorted the proper action of the regulator is to turn on Q503 to provide the short circuit currents. The voltage drop across R503 is proportional to this current and cannot exceed the drop across R504 because of the control of Q502. This drop is limited to the available current from Q503 which is set by R508. Thus the short circuit current is limited and Q501 is protected against excessive dissipation. The diode CR509 compensates for the base-emitter drop of Q502 to maintain the current limiting uniform with changing temperature.

The -20V supply works in the same manner as the +30V supply. It is referenced from the -6.2V ±5% Temperature, compensated zener diode, CR519.

The +11.2V Super Regulated Power Supply is referenced from CR521, a +6.2V ±5% temperature compensated zener diode. R539 and R540 provide the supply sample that is compared to the zener diode voltage. Loop gain for the +11.2V supply regulator is obtained from a μa 709 integrated circuit operational amplifier, Q506. The output of Q506 controls the current through Q512 the series device for the +11.2V supply.

R543 provides current limiting protection for Q512 in case of a short circuit or a current overload on the +11.2 supply buss. CR523 protects the inputs of Q506 from excessive offset voltages which could damage the integrated circuit.

The +5.6V supply is referenced from the +11.2V supply by R544, 545, and 546. The series device Q513 is driven by a differential amplifier consisting of Q514 and Q515. R547,548 and 549 provide current limit protection for Q513 in a manner similar to that described above for the +30V supply.

The -5.6V supply is provided by an emitter follower referenced from the -20V supply. CR520 compensates the reference divider for changes in the emitter to base voltage of Q516 with temperature and helps to maintain a -5.6V output with changes in temperature constant.

The high voltage power supply sets on top of the +30V supply and is programmed by the plug-in in use to provide between +40 and +140V with respect to ground. The comparator-amplifier Q411, 412 has +30V for its reference and the sampler is composed of R443, 444 and R801 in the plug-in. The driver transistor is composed of Q408 and Q409 in series to achieve a high voltage rating. The series transistor, Q410, will regulate up to 40 milliamperes at any output voltage between 40 and 140 volts. Frequency roll-off to control the feedback loop stability is provided by C412. Short circuit protection is established by R435, 439 and 445 in the same manner as the other supplies.

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SECTION 7

RECALIBRATION PROCEDURE

MODEL 610B

In this procedure it is assumed that the circuits being recalibrated are functioning. If the circuits are inoperative or operating improperly, refer to Section 7-17 for a recommended trouble shooting procedure. As an aid in trouble shooting the 610B, a simplified signal flow diagram is given at the beginning of Section 7-17. This diagram shows the major signal flow route in the 610B and indicates the key waveforms that should be used in isolating a problem to a particular stage.

The below Sections 7-1 through 7-6 are sequential and should be followed in that order. Make all tests and adjustments with a plug-in unit installed. Remove the top dust cover of the 610B for access to the printed circuit card socket test points. Unless specified otherwise, all d.c. measurements are made with the chassis as ground reference.

7-1 SETTING OF THE 610B FRONT PANEL CONTROLS

Set the front panel controls as indicated below.

FREQUENCY CONTROL: to CWF1

F1: 10% up from left end.

F2: at 100%.

SWEEP TIME: .01 sec per sweep.

SWEEP TIME VERNIER: CAL.

SWEEP MODE: AUTO.

VAR FREQ: INTENSITY.

VAR FREQ MKR AMP: CCW.

MODULATION: NORMAL.

BIRDIE MKRS AMPLITUDE: CCW.

(6108 PLUG-IN: HI BAND)

Allow 15 minutes warm-up time.

7-2 POWER SUPPLY RECALIBRATION

a) Check for proper voltage at indicated test points using .02% d.c. voltmeter. These test points are at the socket connectors of printed circuit board 610B-5B

Only if these voltages are not within range, see Section 7-9 for Adjustment Procedure.

Pin 1 610B-5B - - - +30V ±10 mv

Pin 5 610B-5B - - - +11.2V ±5mv

Pin 7 610B-5B - - - +5.6V ±5mv

Pin 9 610B-5B - - - -5.6V ±5%

Pin 18 610B-5B- - - -20V ±10 mv

Pin 2 J401 - - - high voltage required by plug-in installed in the instrument ±5%.

NOTE:
In some older instruments the +11.2V Power Supply Voltage is produced by two 5.6 V Zener diodes in series. These diodes are matched in breakdown voltage to within ±20 mv of each other. If these diode voltages are out of tolerance, the diode assembly should be replaced. It is recommended that this be done at the factory.

b) Measure the ac ripple and noise on all supply voltages at the points indicated in part a. Using a Tektronix 503 or other oscilloscope of comparable sensitivity, the ripple and noise on all supplies (except the HIGH VOLTAGE SUPPLY) should be less than 1 mv P-P. The ripple on the HIGH VOLTAGE SUPPLY should be less than 5 mv P-P. If the ripple and/or noise on any of the supply voltages is greater than the above values, see Section 7-17 for trouble shooting procedures.

7-3 SWEEP GENERATOR RECALIBRATION

Set the FREQUENCY CONTROL - F1 to F2 All other controls are as in 7-1.

a) Connect the Vertical Input of a d.c. oscilloscope to Pin 2 of the 610B-3A printed card socket and check for the sweep waveform as shown in Fig. 7A below.

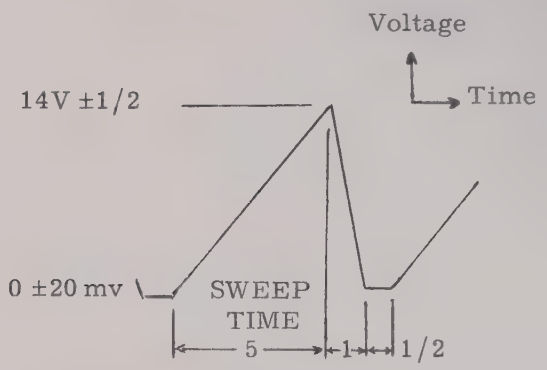


Figure 7A

SWEEP WAVEFORM AT PIN 2 610B-3A

b) With the SWEEP VERNIER on CALIBRATE, check the sweep time on all sweep ranges against the calibrated oscilloscope time base. Sweep times should be within ±20% of dial indication. The relative times for sweep return and hold off, as indicated in Fig. 7A, are ±20% values.

If any of these values are out of tolerance see Section 7-11 and 7-12 for adjustment procedure.

c) Set the SWEEP MODE to LINE and repeat step (b) above. Set the scope trigger source to Line and check the sweep waveform's synchronization with the sweep of the scope. Turn the SWEEP TIME VERNIER through its full range and check for smooth change in sweep time and for at least a 10 to 1 range of control. If adjustments are necessary, see Section 7-11.

d) SET SWEEP MODE to TRIG. and observe that there is no sweep. Press push button on front panel and observe single sweep with each release of button. With a 1V Peak to Peak 10 Hz square wave applied at TRIGGER IN at the rear of the instrument a normal sweep should be observed.

7-4 SWEEP DRIVER RECALIBRATION

Set the FREQUENCY SELECTOR knob in the F1 to F2 position and all other controls as specified in Section 7-1.

a) Connect the output of PIN I of J103 to the Vertical Input of a d.c. oscilloscope (J103 is located on the rear panel of the instrument.) The waveform observed should be the same as the one shown in Fig. 7B.

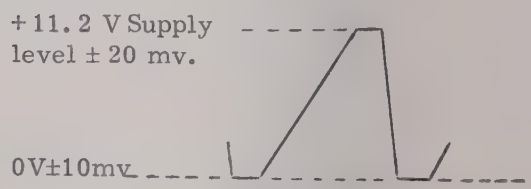


Figure 7B

SWEEP WAVEFORM ON PIN I OF J103

To determine the proper maximum sweep voltage measure the +11.2V supply level on Pin F of J103, using the most sensitive d.c. oscilloscope range possible. This voltage may fall within a 5% tolerance of 11.2V because of the zener diode tolerance. Mark this level on the face of the oscilloscope and without

changing the control settings on the scope, reconnect the Vertical Input to Pin I of J103. The sweep end level of the waveform should be at the same level as the +11.2V mark. If adjustments are necessary, see Section 7-13.

b) MANUAL SWEEP RECALIBRATION

Set SWEEP MODE to MANUAL, FREQUENCY SELECTOR to F1 to F2, and all other controls as specified in Section 7-1. Turn the SWEEP MODE VERNIER CW until the voltage on Pin I of J103 comes up to the +11.2V level described in Section 7-4a. The voltage at the HORIZ OUT on the front panel should be 10 V ±0.2V. If adjustment of the HORIZONTAL OUTPUT voltage is necessary, see Section 7-13c.

7-5 FREQUENCY INSTRUCTION RECALIBRATION

a) Dial assembly mechanical inspection.

1. With the F1, F2 and VAR FREQ MKR controls turned fully to the CCW, all three pointers should be within 1/32" alignment and approximately 1/16" to the left of the scale calibrations.

2. With the above controls turned fully CW, the three pointers should be 1/16" beyond the right end of the scale and have a maximum deviation in position of 1/16".

3. If dial pointers are out of tolerance, see Section 7-14.

b) Set the F1 and F2 pointers exactly on zero. Set the FREQUENCY SELECTOR control to F1 to F2 and set all other controls as in 7-1.

1. View the sweep signal on Pin C J103 (located on the rear panel of the instrument) with an a.c. coupled oscilloscope. The sweep signal should be less than 20 mv peak-to-peak.

2. With the oscilloscope removed, connect a .02% d.c. voltmeter to Pin C of J103. The d.c. voltage present should be 0V ±10 mv.

3. Remove the lower dust cover and, without changing the control settings, connect the .02% d.c. voltmeter to Pin 24 of J401, located on the rear panel of the instrument. The voltage here should be 0 V ±10 mv.

4. Set the F1 and F2 pointers exactly on 100%. Reconnect the d.c. voltmeter to Pin 24 of J401. The voltage on the d.c. voltmeter should be 9.75V ±20 mv.

5. Set the F1 pointer on 0 and the FUNCTION SWITCH to CWF1. The voltage on the d.c. voltmeter should be 0V ±20 mv.

6. Set the VARIABLE FREQ. MARKER to 5% of the dial reading and the FREQ. SELECTOR SWITCH to ΔF. Turn ΔF control to 5 and observe 500 mv Peak to Peak waveform on Pin C J103 with a d.c. oscilloscope.

7. Set the FREQ SELECTOR control to F1 to F2.
Set the F1 pointer exactly on 0.
Set the F2 pointer exactly on 100%.
Connect the vertical input d.c. oscilloscope to Pin 24 of J401.
The waveform seen should be

as shown in Fig. 7C below. This is the sweep waveform that drives the Frequency Control circuits in the plug-in and it will be referred to in the plug-in recalibration procedures.

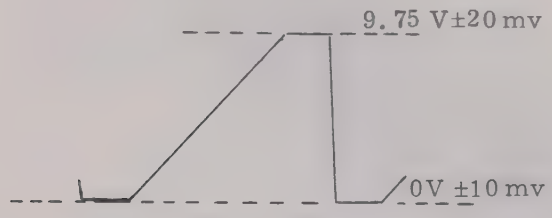


Figure 7C
SWEEP WAVEFORM ON PIN 24 OF J401

8. If any of these voltages are out of tolerance, see Section 7-15 for the adjustment procedure.

7-6 VARIABLE FREQUENCY MARKER RECALIBRATION

Set the FREQ SELECTOR control to F1 to F2 and the VAR FREQ MKR AMP control to VIDEO
All other controls are set as in Section 7-1.
Connect the oscilloscope as shown in Fig. 7D.

a) Set the F1 pointer at 0% of the dial range.
Set the F2 pointer at 10% of the dial range and the
VAR FREQ MKR POINTER on 5% of the dial setting.
Turn VAR FREQ MKR AMP control CW until the video pip is visible. The pip should be in the central ±5% of the sweep.

b) Set the F1 pointer on 90%.
Set the F2 pointer on 100%, and the VARIABLE FREQ pointer on 95%.
Repeat the check made in step a).

c) If the marker is out of tolerance in either step a) or b), see Section 7-10 for adjustment.

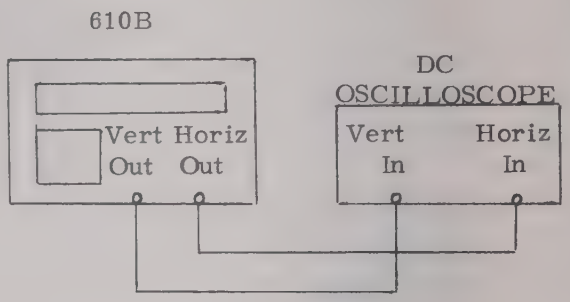


Figure 7D

7-7 LEVEL CONTROL RECALIBRATION

Set front panel controls as in sec. 7-1.

1. With plug-in installed, connect .02% dc voltmeter to pin 10 of J401 (Located on rear panel behind the plug-in). Adjust the RF POWER LEVEL control on the plug-in front panel for -.170V.

2. Connect .02% dc voltmeter to pin 18 of J401. Without changing the plug-in power level control, the voltage on pin 18 should be within ±2mv of the voltage recorded in step 1. above. If this voltage is out of tolerance see sec. 7-16A.

7-8 HARMONIC MARKER RECALIBRATION

Remove the bottom dust cover of the 610B. Unhook the BNC cable from the 61HH or 61H Harmonic marker generator at the Birdie Marker Mixer located on the rear panel of the instrument and connect to HP5246L Electronic Counter. Put both 1 and 10MHz and the 50 and 100 MHz toggle switches to their center positions.

a) Throw the toggle switch on front panel to 10MHz Harmonic and observe the frequency of 10MHz ±1kHz from the Marker Generator.

b) Throw the toggle switch to 1MHz Harmonic and observe the frequency of the 1MHz ±100Hz from the Marker Generator

c) Put 1 and 10MHz toggle switch to its center position and throw the second toggle switch to 50MHz. Observe the frequency of 50MHz ±5kHz from the Marker Generator.

d) Throw the second toggle switch to 100MHz. Observe the frequency of 100MHz ±10kHz from the Marker Generator.

e) If any of the marker generators are out of tolerance, see Sec. 7-16B for adjustment.

ADJUSTMENT PROCEDURES

The adjustments described in this section are to be made only if the voltages and waveforms described in the RECALIBRATION PROCEDURE are out of tolerance. Random adjustment of the internal controls without reference to the recalibration procedure will cause a deterioration of the instrument's overall calibration and accuracy. Most of the internal adjustments are made on controls located on the printed circuit cards mounted on the under side of the main deck. Remove the bottom dust cover for access to these internal adjustments. A card extender is available for access to the adjustable components located on the printed circuit cards.

7-9 POWER SUPPLY ADJUSTMENTS

Set controls as described in Section 7-1.

a) Monitor the +11.2V power supply at Pin 5 of the socket connector of the printed circuit board 610B-5B. The +11.2V supply is adjusted with R537 on the PC 610B-5B. Using a .02% d.c. voltmeter, set the +11.2V supply for 11.200V ±1mv.

Monitor the +5.6V power supply at pin 7 of the socket connector of the printed circuit board 610B-5B. The +5.6V supply is adjusted with R545 on the PC 610B-5B. Using a .02% d.c. voltmeter, set the +5.6V supply for 5.600V ±1mv

Note: Changing the +11.2V supply voltage will require resetting the +30V and -20V supplies. See steps b and c below.

Power Supply Adjustments - Cont'd.

b) Monitor the +30V power supply at Pin 1 of the socket connector of the printed circuit board 610B-5B. The +30V power supply is adjusted with R512 on PC 610B-5B. Using a .02% d.c. voltmeter, set the +30V supply for +30V ±6mv. Changes in the +30V supply may also affect the -20V supply and it should subsequently be checked after adjusting the +30V supply. Monitor the -20V power supply at Pin 18 of printed circuit board 610B-5B.

c) The -20V power supply is adjusted with R524 on PC 610B-5B. The -20V supply should be adjusted only after the +30V supply has been checked. Using a .02% d.c. voltmeter, set the -20V supply for -20V ±4mv.

d) There are no control adjustments for the High Voltage power supply. If this supply is operating improperly, see Sec. 7-17 for Trouble Shooting procedures.

7-10 VARIABLE FREQUENCY MARKER ADJUSTMENTS

Set controls as indicated in Sec. 7-6 and connect the d.c. oscilloscope as shown in Fig. 7C.

a) Set controls as described in Sec. 7-6a. Adjust R322 BALANCE on Pc 610B-2a to place the marker in the center of the sweep ±5%.

b) Set controls as described in Sec. 7-6b. Adjust R317 CALIBRATE on PC 610B-2a to place the marker in the center of the sweep ±5%.

c) Repeat steps a and b until no further adjustment is necessary.

d) Connect the Vertical Input of the d.c. oscilloscope to Pin 5 of the 610B-2a printed card socket. With the VAR FREQ MKR AMP control turned full CW adjust R325 MAX AMP ADJ on PC 610B-2a for a peak of +0.6V. See Fig. 7F.

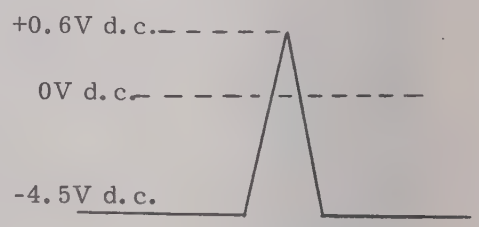


Figure 7F
VIDEO PIP ON PIN 5 OF 610B-2A SOCKET

Variable Frequency Marker Adjustments Cont'd.

e) Connect the Vertical Input of the d. c. oscilloscope to Pin 2 of the 610B-3A printed card socket. With the VAR FREQ MKR AMP control turned fully CW and F1 set on 0% F2 set on 100% full scale, and VAR FREQ MKR set midscale, adjust R341 DWELL ADJUST on PC 610B-2A for a step of 0.4 cm on a 5 cm sweep. See Figure 7G.

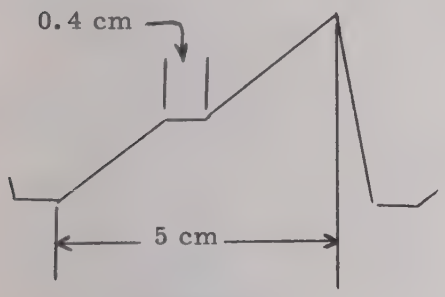


Figure 7G

SWEEP WAVEFORM ON PIN 2 OF 610B-3A

7-11 SWEEP GENERATOR ADJUSTMENTS

Set FREQUENCY SELECTOR to F1 to F2. All other controls set as in 7-1.

Connect the Vertical Input of the d. c. oscilloscope to Pin 2 of the 610B-3A PC socket. and observe the waveform shown in Fig. 7A.

a) Adjust R127 SWEEP START LEVEL on PC 610B-2A for sweep start at 0V ±20 mv.

b) Adjust R131 SWEEP END LEVEL on PC 610B-2A for sweep amplitude of 14V.

c) Turn SWEEP VERNIER (R134) fully CCW and short its wiper to ground. Adjust R126 BIAS ADJUST on PC 610B-3A for slow positive growth of sweep voltage. (NOTE Voltage must not go negative.)

d) Remove short, turn Vernier to CAL and observe sweep. Repeat steps a, b, and c if necessary.

e) Make the following control settings.

FREQUENCY SELECTOR control: F1 to F2.
SWEEP TIME: 1 - .1 sec. per sweep.
SWEEP MODE: LINE SYNC,

Set all other controls as in Sec. 7-1. Connect the Vertical Input of the d. c. oscilloscope to Pin 2 of the 610B-3A PC socket and observe sweep as shown in Fig. 7A. Connect the .02% d. c. voltmeter to Pin 6 of the 610B-3A PC socket.

f) Adjust R138 TRIGGER ADJ, located on the under side of the main deck, until the sweep just stops. Turn the SWEEP MODE control on the front panel to TRIG and record the voltage on Pin 6 of the 610B-3A PC socket.

g) With the SWEEP MODE in the TRIG position, adjust R138 TRIGGER ADJ. until the sweep starts again. This is a free running sweep. Back off on R138 until the sweep just stops and record the voltage on Pin 6 of the 610B-3A PC socket.

h) With the SWEEP MODE still in the TRIG. position, adjust R138 for a voltage on Pin 6 of the 610B-3A PC socket midway between the two voltages recorded in parts a and b ± 50 mv.

i) After adjusting R138 note that there is no sweep in the TRIG position of the SWEEP MODE and a normal sweep in the LINE SYNC position.

If proper sweep cannot be obtained, see Sec. 7-17 for Trouble Shooting Guides.

7-12 EXT TRIG and HOLD OFF ADJUSTMENTS

a) Set FREQUENCY SELECTOR: F1 to F2. Set SWEEP MODE to TRIG. Set all other controls as in Sec. 7-1. Connect the Tektronix 181 Time Base Generator through an attenuating network to the TRIGGER IN jack at the rear of the instrument. See Fig. 7H. Set the Tektronix 181 OUTPUT SELECTOR to 1 ms OUTPUT.

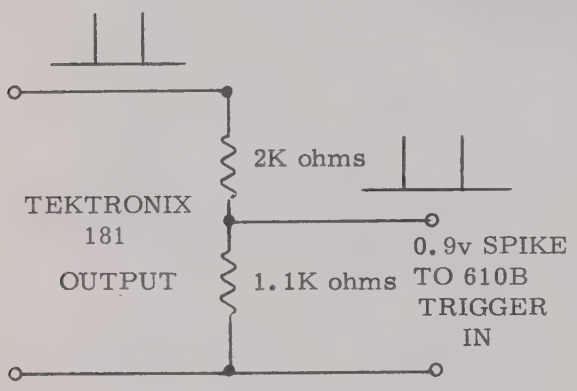


Figure 7H

ATTENUATOR NETWORK FOR EXT. TRIGGER ADJ.

b) With a 0.9v spike applied to the TRIGGER IN, a normal sweep should be observed at Pin 2 of the 610B-3A PC socket. If there is no sweep, adjust R148 EXT TRIG ADJ on the 610B-3A PC until a sweep is obtained. Set the control for the middle of its operating range.

c) With the sweep triggered externally as described in e and f, turn the SWEEP TIME selector through all of its ranges and check each range for the minimum hold-off time described in Sec. 5-3. If any range has a hold-off time less than the minimum, adjust R151 HOLD-OFF ADJ on the 610B-3A PC to bring the hold-off time up to the minimum.

If all of the hold-off times are over the minimum, bring the shortest hold-off time down to the minimum with R151.

If it is impossible to achieve any of these steps, see Sec. 7-17 for the Trouble Shooting procedure.

In some of the early 610B models, provisions for EXT TRIG ADJ and HOLD-OFF ADJ were not incorporated.

7-13 SWEEP DRIVE ADJUSTMENTS

Set the FREQUENCY SELECTOR control in the F1 to F2 position. Set all other controls as described in Section 7-1.

a) View the +11.2 V on Pin F of J103 using an a.c. oscilloscope at max. sensitivity. Adjust R216 — SWEEP RIPPLE ADJUST on PC 610B-1A for minimum ripple.

b) View the sweep on Pin I of J103 with a d.c. oscilloscope. Adjust the sweep start level with R 206 — BEGIN ADJUST located on the main deck for 0 V ±10 mv.

c) Calibrate the vertical gain of the oscilloscope with reference to the +11.2V supply as described in Sec. 7-4b.

1. With the d.c. oscilloscope connected to Pin I of J 103, adjust the sweep end level with R 201 END ADJUST, located on the main deck, to the same level as the +11.2 V supply ±20 mv.

2. Turn SWEEP MODE to MAN. and turn the vernier until the sweep on the oscilloscope is at the +11.2 V level. Connect the .02% d.c. voltmeter to the HORIZ OUT on the front panel and adjust R209 HORIZ CAL located on the 610B-1A PC for 10 V ±50 mv on the voltmeter.

7-14 MECHANICAL ADJUSTMENT OF DIAL POINTERS

a) Turn all three pointer controls CCW until they reach the end of their travel. Adjust the F1 and F2 pointers by loosening the 4-40 set screw in the top of the slide block and aligning the pointers 1/16" beyond the 0 marker of the dial. When tightening the set screw, do not apply torque as this may damage the dial cord.

b) To adjust the VAR FREQ MARKER pointer loosen the set screw in the rear of the slide block which is accessable through the 3/8" hole in the dial frame and bring pointer into alignment with F1 and F2.

c) In some of the early 610B models provisions for adjusting the pointer were not incorporated. To adjust the pointer position in one of these instruments, it is necessary to loosen the two set screws on the potentiometer dial control drum that hold the drum to the potentiometer, and turn the drum to achieve the desired alignment.

7-15 FREQUENCY INSTRUCTION ADJUSTMENT

Caution: Do not perform the following calibration if the frequency instruction accuracy is acceptable.

NOTE: Mechanical Alignment of dial pointers must be correct to have proper results from these adjustments! See Sec. 7-5a for mechanical inspection of dial pointers.

a) Set FREQUENCY SELECTOR — F1 TO F2
Set all other controls as described in Sec. 7-1.

1. Set F1 and F2 pointers exactly on 0. Connect the d.c. oscilloscope to Pin C of J103 on the rear deck of the instrument and observe the sweep waveforms. Adjust R231 TRACKING on the 610B-1A PC for a minimum amplitude of the sweep waveform. Disconnect the oscilloscope.

2. Connect the .02% d.c. voltmeter to Pin C of J 103 in place of the oscilloscope. Adjust R245 FREQ ZERO on the main deck for 0V ±5 mv on the voltmeter.

3. Set F1 and F2 pointers exactly on 0. Connect the .02% d.c. voltmeter to Pin 24 of J 401 located on the rear deck of the instrument. Adjust R354 FREQUENCY CONTROL ZERO (this is the unmarked thumb-pot on the upper side of the main deck located at the rear of the deck) for 0V ±5 mv.

4. Set F1 and F2 pointers exactly on 100%. Adjust R233 AMPLITUDE on the 610B-1A PC for 9.75 ±10mv on the voltmeter.

5. Repeat steps 2 and 3 above until the voltages stay within their tolerances.

b) Set FREQUENCY SELECTOR to CW F1 and the F1 pointer exactly on zero. With the .02% d.c. voltmeter connected to Pin 24 of J401. adjust R243 ΔF OFFSET on PC 610B-1A for 0V ±10 mv.

c) Set FREQUENCY SELECTOR to ΔF.
Set VAR FREQ MARKER to 5% of the dial scale. Turn ΔF control to 5 and observe sweep on Pin C of J103. with the d.c. oscilloscope. Adjust R225 ΔF CAL for a 500 mv ±50 mv P-P sweep waveform.

Frequency Instruction Adjustment Cont'd.

d) Repeat Recalibration Section 7-5b to insure the correct recalibration of the frequency instruction circuits. If the correct voltages and waveforms cannot be obtained, see Section 7-17 for trouble shooting suggestions.

7-16A LEVEL CONTROL ADJUSTMENT.

Set front panel controls as in Sec. 7-1.

1. With plug-in installed, connect .02% dc voltmeter to pin 19 of J401 (Located on the rear panel behind the plug-in). Adjust the RF Power Level control on the plug-in front panel for about -170mv on pin 19. Record the voltage.

2. Connect .02% dc voltmeter to pin 18 of J401 without changing the plug-in power level control, adjust R408 LEVEL BALANCE ADJ on PC 610B-4 to bring the voltage on pin 18 to within 0.2mv of the voltage recorded above in step 1.

7-16B HARMONIC MARKER GENERATOR ADJUSTMENT

Connect counter to output of harmonic marker Generator as described in Sec. 7-8.

See Fig 7-I below for location of adjustments.

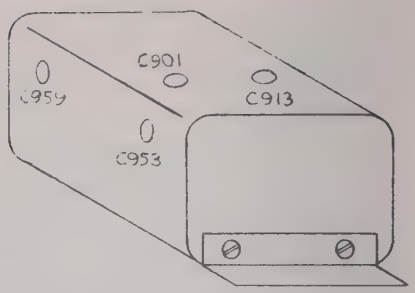


Fig 7I - 61HH adjustment locations

a) To adjust the 10MHz harmonic, adjust C913 to produce a signal 10MHz ±1kHz.

b) To adjust the 1MHz harmonic adjust C901 to produce a signal 1MHz ±100Hz.

c) To adjust the 50MHz harmonic adjust C953 to produce a signal of 50MHz ±5kHz.

d) To adjust the 100MHz harmonic adjust C959 to produce a signal of 100MHz ±10kHz.

e) To adjust the 61H 1 and 10 MHz Harmonic Marker it is necessary to remove the front end and the cover of the unit to reach the adjustments.

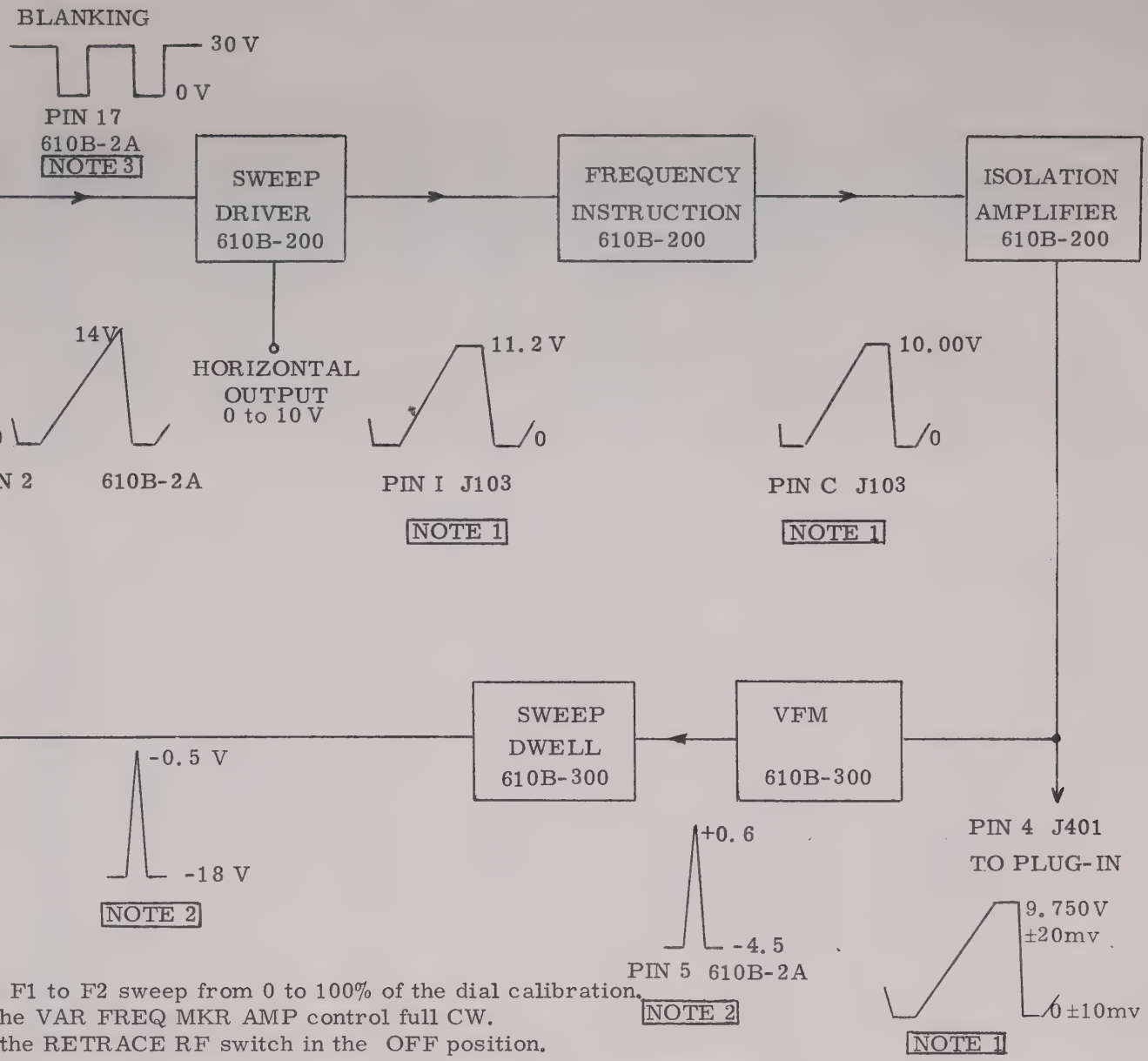


FIGURE 7-17A
SIMPLIFIED 610B SIGNAL FLOW DIAGRAM

NOTES:

1. Waveforms are for F1 to F2 sweep from 0 to 100% of the dial calibration.
2. Waveform is with the VAR FREQ MKR AMP control full CW.
3. Waveform is with the RETRACE RF switch in the OFF position.
4. Numbers inside the boxes designate drawing number for schematic diagrams of the circuits.

610B TROUBLE SHOOTING CHART

GENERAL

INDICATION	POSSIBLE CAUSE AND REMEDY
No RF OUTPUT	a) Check RETRACE RF switch. If it is in the ON position there will be no base line since the RF is on during the retrace. b) See Plug-In Trouble Shotting guide.
No Horizontal Sweep	a) Check control settings, see Section 2. b) Check for sweep at Pin 2 of 610B-3A PC socket. (See Fig. 7A) 1. If good see Sweep Driver Trouble Shooting procedure. 2. If bad see Sweep Generator Trouble Shooting Procedure.
Cannot sweep full frequency range	a) Check front panel control settings. FREQUENCY SELECTOR - F1 to F2 MODULATION - NORMAL b) Check power supply voltages as described in Section 7-2. c) Check waveform at Pin 24 of J401 on rear panel of 610B. (See Section 7-5, step 7, for description of the waveform.) 1. If the waveform is correct, see the plug-in trouble shooting procedure. 2. If the waveform is bad refer to Section 7-2 through 7-5 for Recalibration procedure.
No VARIABLE FREQUENCY MARKER indication	a) Check for proper waveform at Pin 24 J401 on rear panel (see section 7-5, step 7, for description of the waveform.) 1. If the waveform is bad refer to Section 7-2 through 7-5 for Recalibration procedure.

610B TROUBLE SHOOTING CHART

GENERAL Cont'd.

INDICATION	POSSIBLE CAUSE AND REMEDY
No VARIABLE FREQUENCY MARKER indication (continued)	2. If the waveform is good see the Trouble Shooting Chart for the VARIABLE FREQUENCY MARKER.
External RF MARKER does not operate but internal markers are o. k.	a) Turn off harmonic markers. All marker RF signals are fed into a single mixer. The 1 and 10 MHz harmonic markers beat with all other RF marker inputs. b) Use larger amplitude signal (1 V).
NARROW markers are poorly shaped but WIDE markers are o. k.	a) Reduce sweep rate to 0. 1 seconds per sweep or less.
Noise on detected output.	a) Turn BIRDIE MARKER AMPLITUDE control full CCW.
No birdie markers	a) No output from Harmonic Marker Generator. (See Section 7-8 for recalibration procedure.) b) Mixer diode defective. Check diode in mixer assembly located on the 610B rear panel for a front to back resistance ratio of 100 or greater. c) Video amplifier defective. Check Q301 and Q302 on Printed card 610B-2A.
External level function does not work	a) Adjust EXT LEVEL ADJ (screwdriver adjustment on front panel) for levelled condition. b) Leveling circuit out of balance see Sec. 7-16A for adjustment procedure.

610B TROUBLE SHOOTING CHART

GENERAL Cont'd.

INDICATION	POSSIBLE CAUSE AND REMEDY
No level control, unlevelled, or light stays on	a) Turn MODULATION SWITCH to NORMAL b) See plug-in Trouble Shooting guide for level circuit trouble shooting.
Cannot externally frequency program over the whole frequency range	a) Turn FREQ CONTROL on the front panel to REMOTE b) Program circuit impedance is too low. See Section 4.
Cannot make phase lock function work	a) Check the time constants of the external phase lock control system.

POWER SUPPLY

+11.2V supply cannot be adjusted; or excessive noise on +11.2V supply.	a) CR521 is defective b) Q506 is defective c) Check +30 V supply for large AC ripple.
+30V Supply cannot be adjusted. +11.2V supply is o.k.	a) Check Q502, Q503, Q504, and Q506. b) Check CR501, CR502, CR503, and CR504 for open (located on TB-1).
+30V supply high with large AC ripple and cannot be adjusted	a) Q501 or Q502 shorted. b) Check Q503 and Q506.
-20V Supply cannot be adjusted. +30V Supply is o.k.	a) CR519 is defective. b) Check Q508, Q509, Q510, Q511. c) Check CR505, CR506, CR507, and CR508 for open. (Located on TB-1).

610B TROUBLE SHOOTING CHART
POWER SUPPLY Cont'd.

INDICATION	POSSIBLE CAUSE AND REMEDY
High voltage supply at +160V	a) Check to see that plug-in is properly installed. b) Q410 shorted c) Check Q411 and Q412
High voltage supply low or inoperative	a) Check +30V supply for proper operation b) Check Q411 and Q412
Excessive ripple on all supplies	a) Make sure you are using a low frequency oscilloscope. b) Check 11.2V supply for proper operation (See Section 7-2). c) Set FREQUENCY SELECTOR to CWF1.
Noise on +30V supply, +11.2V supply o.k.	a) Set FREQUENCY SELECTOR to CWF1. b) Q503 or Q504 is noisy. c) Q506 is noisy or intermittent.
Noise on -20V supply, +11.2V and +30V supplies o.k.	a) Q509 or Q510 is noisy. b) Q511 is noisy or intermittent c) CR519 is defective.
Noise on +5.6V supply or cannot ADJ +5.6V supply (11.2V supply o.k.)	a) Q513 or Q514 or Q515 is defective.

610B TROUBLE SHOOTING CHART

SWEEP GENERATOR

INDICATION	POSSIBLE CAUSE AND REMEDY
No sweep	a) Check setting of SWEEP MODE and FREQUENCY SELECTOR controls on front panel. b) Turn CCW the amplitude control of the VAR FREQ. MKR. c) Check Pin 2 of printed circuit board 610B-3A. If there is no sweep check SWEEP BIAS ADJUST setting (See Section 7-11). d) *Check Q104 and Q107
Sweep too slow. Vernier has little or no effect on sweep speed	a) Check Q310 in PC 610B-2A. b) If the frequency determining plug-in is not installed, this will cause the problem.
Sweep time too slow/fast on all ranges	a) Check SWEEP BIAS ADJ setting. (See Section 7-11.) b) *Replace Q104.
No sweep or jumpy sweep on line sync, auto o. k.	a) Reset sweep trigger level. (See Section 7-12.)
No BLANKING OUT - Sweep o. k.	a) Check Q108.
No Base Line on Detected Output	a) Turn RETRACE RF to OFF. b) Check to see that you are getting RF output from plug-in. c) Check Q109.
Sweep stops part way through its cycle	a) Turn VARIABLE FREQ. MKR. AMPLITUDE to CCW. (If this frees the sweep, See Section 7-10 for marker amplitude adjustment.)

*Changing Q104 may require a change in R116 to achieve proper sweep times. See Section 7-4 for Recalibration procedure.

610B TROUBLE SHOOTING CHART

SWEEP DRIVE

INDICATION	POSSIBLE CAUSE AND REMEDY
END ADJUST cannot bring sweep drive output up to +11.2V supply level	a) Check output of Sweep Generator on Pin 2 610B-3A for proper sweep waveform and amplitude. (See Figure 7A.) b) Check power supply voltages. (See Section 7-2.)

FREQUENCY INSTRUCTION

Cannot adjust FREQUENCY ZERO for 0V on Pin C of J103	a) Check setting of front panel controls and frequency control pointers. (See Section 7-5.) b) Check Q203 differential amplifier on PC 610B-1A for unbalanced inputs using .02% d.c. voltmeter.
No sweep waveform on Pin 24 J401 but Sweep WF is o.k. on Pin C J103	a) Check for Jumper between Pins B and C on J103. b) Check ISOLATION AMPLIFIER for proper operation. c) Check input circuit of plug-in for short circuit.

610B TROUBLE SHOOTING CHART
VARIABLE FREQUENCY MARKER

INDICATION	POSSIBLE CAUSE AND REMEDY
Cannot recalibrate Variable Frequency marker	a) Check Q306 and Q307 for balanced operation. b) CR305 or CR306 defective. c) Q305 defective.
No intensity but Video marker o. k.	a) Q310 defective. b) Dwell adjust out of tolerance. (See Section 7-10.)
No RF marker but Video and intensity markers o. k.	a) Check MAX AMP ADJ setting, See Section 7-10.

REQUIRED TEST EQUIPMENT

INSTRUMENT	REQUIRED CHARACTERISTICS	RECOMMENDED INSTRUMENT
DC Voltmeter	a) .02% Accuracy b) Input impedance greater than 5 megaohms c) Resolution of 1mv or greater d) Center scale zero	JOHN FLUKE Model 871
DC Oscilloscope	a) 300 KC Bandwidth and horizontal amplifiers, internal sweep b) Vertical sensitivity of 1 mv/cm for AC and DC inputs c) Horizontal input for external sweep signal	TEKTRONIX Model 503
V O M (Volt-ohm-meter	a) 20,000 ohm/V DC	SIMPSON Model 270
PULSE GENERATOR	a) 1 kHz pulse rate with 10ms or less period	TEKTRONIX 181 TIME MARK GENERATOR
CRYSTAL DETECTOR	a) Flat Response (±1 db 100 kHz to 4 GHz) b) Good RF bypassing 100 kHz to 4 GHz	WILTRON Model 61DN
PLUG-IN EXTENDER CABLE	a) 3 FT. LENGTH b) Shielded cables for small signals	WILTRON Model 610B-TI
ELECTRONIC COUNTER	a) 50 ohm input. b) 100kHz to 2GHz range	HP5246L

REQUIRED TEST EQUIPMENT Cont'd.

INSTRUMENT	REQUIRED CHARACTERISTICS	RECOMMENDED INSTRUMENT
RF POWER METER	a) CALIBRATED in dbm b) ±.5 dbm accuracy or better c) 50 ohms input impedance d) Maximum power reading 0 dbm or greater e) Frequency range from 10 MHz to 400 MHz	-hp- 431C POWER METER
RF SIGNAL GENERATOR	a) Frequency range of 10 MHz to 400 MHz b) Calibrated power output in dbm. c) Signal attenuation of 40 db or greater	MEASUREMENTS Model 80

Resistors

R101	10K	1/4W	5%	Fixed	Comp
R102	1.2K	1/4W	5%	Fixed	Comp
R103	10K	1/4W	5%	Fixed	Comp
R104	9.1K	1/4W	5%	Fixed	Comp
R105	6.8K	1/4W	5%	Fixed	Comp
R106	910	1/4W	5%	Fixed	Comp
R107	10K	1/4W	5%	Fixed	Comp
R108	27K	1/4W	5%	Fixed	Comp
R109	10K	1/4W	5%	Fixed	Comp
R110	100K	1/4W	5%	Fixed	Comp
R111	56K	1/4W	5%	Fixed	Comp
R112	13K	1/4W	5%	Fixed	Comp
R113	43K	1/4W	5%	Fixed	Comp
R114	5.6K	1/4W	5%	Fixed	Comp
R115	27K	1/4W	5%	Fixed	Comp
R116	360K*	1/4W	5%	Fixed	Comp
R117	36K	1/4W	5%	Fixed	Comp
R118	2K	1/4W	5%	Fixed	Comp
R119	36K	1/4W	5%	Fixed	Comp
R120	5.6K	1/4W	5%	Fixed	Comp
R121	1.5K	1/2W	10%	Fixed	Comp
R122	3.3K	1/4W	5%	Fixed	Comp
R123	10K	1/4W	5%	Fixed	Comp
R124	470K	1/4W	5%	Fixed	Comp
R125	4.7K	1/4W	5%	Fixed	Comp
R126	10K	141-10K		Var	Comp
R127	5K	141-5K		Var	Comp
R128	4.7K	1/4W	5%	Fixed	Comp
R129	47K	1/4W	5%	Fixed	Comp
R130	7.5K	1/4W	5%	Fixed	Comp
R131	5K	141-5K		Var	Comp
R132	4.7K	1/4W	5%	Fixed	Comp
R133	7.5K	1/4W	5%	Fixed	Comp
R134	100K	part of 410-47(S102)		Var	Comp
R135	6.8K	1/4W	5%	Fixed	Comp
R136	8.2M	1/4W	5%	Fixed	Comp
R137*	150K	1/4W	5%	Fixed	Comp
R138	10K	142-10K		Var	Comp
R139	10K	1/2W	10%	Fixed	Comp
R140	18K	1/2W	10%	Fixed	Comp
R141	4.7K	1W	10%	Fixed	Comp
R142	36K	1/4W	5%	Fixed	Comp
R143	39K	1/4W	5%	Fixed	Comp
R145	27K	1/4W	5%	Fixed	Comp
R146	180	1W	10%	Fixed	Comp
R147	56K	1/4W	5%	Fixed	Comp
R148	10K	141-10K		Var	Comp
R149	27K	1/4W	5%	Fixed	Comp
R150	10K	1/4W	5%	Fixed	Comp
R151	10K	141-10K		Var	Comp
R152	10K	1/4W	5%	Fixed	Comp
R201	50K	142-50K		Var	Comp
R202	220	1/4W	5%	Fixed	Comp
R203	10K	1/4W	5%	Fixed	Comp
R204	820	1/4W	5%	Fixed	Comp
R205	22K	1/4W	5%	Fixed	Comp
R206	100K	142-100K		Var	Comp
R207	15K	1/4W	5%	Fixed	Comp
R208	50K	141-50K		Var	Comp
R209	8.2K	1/4W	5%	Fixed	Comp
R210	1M	1/4W	5%	Fixed	Comp
R211	2.4K	1/2W	5%	Fixed	Comp
R212	27K	1/4W	5%	Fixed	Comp
R213	100K	1/4W	5%	Fixed	Comp
R214	180K	1/4W	5%	Fixed	Comp
R215	10K	141-10K		Var	Comp
R216	7.5K	1/4W	5%	Fixed	Comp
R217	470K	1/4W	5%	Fixed	Comp
R218	3.3K	1/4W	5%	Fixed	Comp
R219	1.1K	1/4W	1%	Fixed	Film
R220	2K	1/4W	1%	Fixed	Film
R221	Wiltron no 150-2K 10 turn			Var	WW
R222	Wiltron no.150-2K 10 turn			Var	WW
R223	Wiltron no.150-2K 10 turn			Var	WW
R224	39K	1/4W	5%	Fixed	Comp
R225	5K	143-5K		Var	Comp
R226	50K	142-50K		Var	Comp
R227	124K	1/2W	1%	Fixed	Film
R228	82.5K	1/2W	1%	Fixed	Film
R229	187K	1/4W	1%	Fixed	Film
R230	82.5K	1/2W	1%	Fixed	Film
R231	10K	153-10K		Var	WW

Resistors

R232	105K	1/2W 1%	Fixed	Film
R233	5K	151-5K	Var	Film
R234	27.4K	1/2W 1%	Fixed	Film
R235	82.5K	1/2W 1%	Fixed	Film
R236	187K	1/4W 1%	Fixed	Film
R237	113K	1/2W 1%	Fixed	Film
R238	37.4K	1/2W 1%	Fixed	Film
R239	8.25K	1/2W 1%	Fixed	Film
R240	37.4K	1/2W 1%	Fixed	Film
R241	37.4K	1/2W 1%	Fixed	Film
R242	27.4K	1/2W 1%	Fixed	Film
R243	10K	153-10K	Var	WW
R244	1M	1/2W 1%	Fixed	Film
R245	1M	142-1M	Var	Comp
R247	1K	1/4W 5%	Fixed	Comp
R248*	330K	1/4W 5%	Fixed	Comp
R249	5K	141-5K	Var	Comp
R250	7.5K	1/4W 5%	Fixed	Comp
R251	2.4K	1/4W 5%	Fixed	Comp
R252	100	1/4W 5%	Fixed	Comp
R253	1K	1/4W 5%	Fixed	Comp
R254	39K	1/4W 5%	Fixed	Comp
R255	10K	1/4W 5%	Fixed	Comp
R256	150K	1/4W 5%	Fixed	Comp
R301	100K	1/4W 5%	Fixed	Comp
R302	15K	1/4W 5%	Fixed	Comp
R303	2.2K	1/4W 5%	Fixed	Comp
R304	100K	1/4W 5%	Fixed	Comp
R305	20K	1/4W 5%	Fixed	Comp
R306	6.8K	1/4W 5%	Fixed	Comp
R307	1K	1/4W 5%	Fixed	Comp
R308	1.5K	1/4W 5%	Fixed	Comp
R309	100	1/4W 5%	Fixed	Comp
R310	2K	1/4W 5%	Fixed	Comp
R311	100K	Part of 410-47(S311)	Var	Comp
R312	47K	1/4W 5%	Fixed	Comp
R314	180K	1/4W 5%	Fixed	Comp
R315	47K	1/4W 5%	Fixed	Comp
R316	82.5K	1/2W 1%	Fixed	Film
R317	10K	153-10K	Var	WW
R318	174K	1/2W 1%	Fixed	Film
R320	300K	1/4W 5%	Fixed	Comp

Resistors

R321	300K	1/4W 5%	Fixed	Comp
R322	10K	153-10K	Var	WW
R322A	10K	1/4W 5%	Fixed	Comp
R323	200K	1/4W 5%	Fixed	Comp
R324	62K	1/4W 5%	Fixed	Comp
R325	12K	1/4W 5%	Fixed	Comp
R326	10K	141-10K	Var	Comp
R327	100K	Part of 410-47(S327)	Var	Comp
R328	20K	1/4W 5%	Fixed	Comp
R329	20K	1/4W 5%	Fixed	Comp
R330	390K	1/4W 5%	Fixed	Comp
R331	10K	1/4W 5%	Fixed	Comp
R332	47K	1/4W 5%	Fixed	Comp
R333	39K	1/4W 5%	Fixed	Comp
R334	12K	1/4W 5%	Fixed	Comp
R335	56K	1/4W 5%	Fixed	Comp
R336	2.2K	1/4W 5%	Fixed	Comp
R337	10K	1/4W 5%	Fixed	Comp
R338	20K	1/4W 5%	Fixed	Comp
R339	470K	1/4W 5%	Fixed	Comp
R340	24K	1/4W 5%	Fixed	Comp
R341	10K	141-10K	Var	Comp
R342	20K	1/4W 5%	Fixed	Comp
R343	82K	1/4W 5%	Fixed	Comp
R344	4.7K	1/4W 5%	Fixed	Comp
R345				
R346				
R347	10K	1/4W 5%	Fixed	Comp
R348				
R349	82K	1/4W 5%	Fixed	Comp
R350	100K	1/4W 5%	Fixed	Comp
R351	47K	1/4W 5%	Fixed	Comp
R352				
R353				
R354	15K	1/4W 5%	Fixed	Comp
R401	10K	1/4W 5%	Fixed	Comp
R402	50K	142-50K	Var	Comp
R403	1.5K	1/4W 5%	Fixed	Comp
R404	1K	1/4W 5%	Fixed	Comp
R405	10K	1/4W 5%	Fixed	Comp
R406	100K	1/4W 5%	Fixed	Comp
R407	150K	1/4W 5%	Fixed	Comp
R408	1K	141-1K	Var	Comp
R409	270K	1/4W 5%	Fixed	Comp
R410	15K	1/4W 5%	Fixed	Comp

*Factory Selected Value

Resistors

R411	1K	1/4W	5%	Fixed Comp
R412	33K	1/4W	5%	Fixed Comp
R413	330	1/4W	5%	Fixed Comp
R414	68K	1/4W	5%	Fixed Comp
R415	36K	1/4W	5%	Fixed Comp
R416	5.1K	1/4W	5%	Fixed Comp
R417	15K	1/4W	5%	Fixed Comp
R418	10K	1/4W	5%	Fixed Comp
R419	1K	1/4W	5%	Fixed Comp
R420	120K	1/4W	5%	Fixed Comp
R421	100K	1/4W	5%	Fixed Comp
R422	270K	1/4W	5%	Fixed Comp
R423	2.2K	1/4W	5%	Fixed Comp
R424	9.1K	1/4W	5%	Fixed Comp
R425	56K	1/4W	5%	Fixed Comp
R426	9.1K	1/4W	5%	Fixed Comp
R427	1M	142-1M		Var Comp
R428	10K	1/4W	5%	Fixed Comp
R429	2K	1/4W	5%	Fixed Comp
R430	160K	1/4W	5%	Fixed Comp
R431	9.1K	1/4W	5%	Fixed Comp
R432	130K	1/4W	5%	Fixed Comp
R433	15K	1/4W	5%	Fixed Comp
R434	5.1K	1/4W	5%	Fixed Comp
R435	15	1/4W	5%	Fixed Comp
R438	47	1/4W	5%	Fixed Comp
R439	2.4K	1/4W	5%	Fixed Comp
R440	120K	1/4W	5%	Fixed Comp
R441	200K	1/4W	5%	Fixed Comp
R442	15K	1/4W	5%	Fixed Comp
R443	110K	1/4W	5%	Fixed Comp
R444	30K	1/4W	5%	Fixed Comp
R445	62K	1/4W	5%	Fixed Comp
R446	39K	1/4W	5%	Fixed Comp
R447	6.8K	1/4W	5%	Fixed Comp
R448	68K	1/4W	5%	Fixed Comp
R449	68K	1/4W	5%	Fixed Comp
R450	330K	1/4W	5%	Fixed Comp
R451	120K	1/2W	10%	Fixed Comp
R452	22K	1/4W	5%	Fixed Comp
R453	6.2K	1/4W	5%	Fixed Comp
R454	1K	1/2W	1%	Fixed Metal film
R455	91K	1/4W	5%	Fixed Comp
R456	680	1/4W	5%	Fixed Comp

Resistors

R458	1K	1/4W	5%	Fixed Comp
R501	47K	1/4W	5%	Fixed Comp
R502	1 ohm	3W	5%	Fixed WW
R503	1 ohm	3W	5%	Fixed WW
R504	1K	1/4W	5%	Fixed Comp
R505	3K	1/2W	5%	Fixed Comp
R506	27K	1/4W	5%	Fixed Comp
R507	27K	1/4W	5%	Fixed Comp
R508	15K	1/4W	5%	Fixed Comp
R509	3.9K	1/4W	5%	Fixed Comp
R510	3.74K	1/8W	1%	Fixed Film
R511	27.4K	1/4W	1%	Fixed Film
R512	50K	141-50K		Var Comp
R513	2.21K	1/8W	1%	Fixed Film
R514*	36	1/4W	5%	Fixed Comp
R515	11K	1/4W	5%	Fixed Comp
R516	1.5K	1/4W	5%	Fixed Comp
R517	1 ohm	3W	5%	Fixed WW
R518	1 ohm	3W	5%	Fixed WW
R519	1.5K	1/4W	5%	Fixed Comp
R520	8.2K	1/4W	5%	Fixed Comp
R521	30K	1/4W	5%	Fixed Comp
R522	56K	1/4W	5%	Fixed Comp
R523	15K	1/4W	5%	Fixed Comp
R524	50K	141-50K		Var Comp
R525	9.09K	1/8W	1%	Fixed Film
R526	22.1K	1/4W	1%	Fixed Film
R527	3.4K	1/8W	1%	Fixed Film
R528	1K	1/4W	5%	Fixed Comp
R529*	100	1/4W	5%	Fixed Comp
R530	13K	1/4W	5%	Fixed Comp
R531	2K	1/4W	5%	Fixed Comp
R532	1.5K	1/4W	5%	Fixed Comp
R533	10K	1/2W	10%	Fixed Comp
R534	10K	1/2W	10%	Fixed Comp
R535	3K	1/4W	5%	Fixed Comp
R536	50K	141-50K		Var Comp
R537	4.42K	1/4W	1%	Fixed Film
R538	510	1/4W	5%	Fixed Comp
R539	1K	1/4W	1%	Fixed WW
R540	1.24K	1/4W	1%	Fixed WW

*Factory Selected Value

Resistors

R541	1.5K	1/4W	5%	Fixed Comp
R542	2K	1/4W	5%	Fixed Comp
R543	400	3W	5%	WW
R544	5.62K	1/8W	1%	Fixed Film
R545	500	141-500		Var Comp
R546	5.62K	1/8W	1%	Fixed Film
R547	1.5K	1/4W	5%	Fixed Comp
R548	2.4K	1/4W	5%	Fixed Comp
R549	510	1/4W	5%	Fixed Comp
R550	2.7K	1/4W	5%	Fixed Comp
R551	11K	1/8W	1%	Fixed Film
R552	2K	1/8W	1%	Fixed Film
R553	9.09K	1/8W	1%	Fixed Film
R554	1.2K	1/4W	5%	Fixed Comp
R555	1K	1/2W	5%	Fixed Comp

Capacitors

C101	.1μf	200V	20%	Fixed Mylar
C102	5pf	500V	5%	Fixed Mica
C103	.001μf	1KV	10%	Fixed Ceram
C104	.001μf	1KV	10%	Fixed Ceram
C105	68pf	500V	5%	Fixed Mica
C106	.001μf	1KV	10%	Fixed Ceram
C107A	1μf	250V	10%	Fixed met poly
C107B	1μf	250V	10%	Fixed met poly
C108A	.1μf	250V	10%	Fixed met poly
C108B	.1μf	250V	10%	Fixed met poly
C109	.02μf	200V	5%	Fixed Mylar
C110	.002μf	125V	5%	Fixed Poly
C111	50μf	25V		Fixed Lytic
C112	5μf	50V		Fixed Lytic
C113	.47μf	250V	20%	Fixed Mylar
C114	.047μf	250V	10%	Fixed Mylar
C115	.02	500V	20%	Fixed Ceram
C116	7pf	500V	5%	Fixed Mica
C117	7pf	500V	5%	Fixed Mica
C118	51pf	500V	5%	Fixed Mica
C119	7pf	500V	5%	Fixed Mica
C201	.001μf	1KV	10%	Fixed Ceram
C202	.02μf	500V	20%	Fixed Ceram
C203	.001μf	1KV	10%	Fixed Ceram

Capacitors

C301	.001μf	1KV	10%	Fixed Ceram
C302	.01μf	500V	20%	Fixed Ceram
C303	.05μf	100V	+80-20%	Fixed Ceram
C304	2000pf	250V	5%	Fixed Poly
C305	32μf	64V		Fixed Lytic
C306	.01μf	500V	20%	Fixed Ceram
C307	32μf	64V		Fixed Elect
C308	.01μf	500V	20%	Fixed Ceram
C309	32pf	64V		Fixed Lytic
C311	270pf	500V	5%	Fixed Mica
C312	47pf	500V	5%	Fixed Mica
C313	270pf	500V	5%	Fixed Mica
C314	.01μf	500V	20%	Fixed Ceram
C401	6.8μf	35V		Fixed Lytic
C402	6.8μf	35V		Fixed Lytic
C403	1μf	200V	20%	Fixed Mylar
C404	.1μf	200V	20%	Fixed Mylar
C405	47pf	500V	5%	Fixed Mica
C406	.001μf	1KV	10%	Fixed Ceram
C407	.0047μf	500V	20%	Fixed Ceram
C408	.001μf	1KV	10%	Fixed Ceram
C409	.033μf	100V	10%	Fixed Mylar
C410	.033μf	100V	10%	Fixed Mylar
C411A	80μf	150V		Fixed Lytic
C411B	50μf	150V	250-21	Fixed Lytic
C412	.1μf	250V	20%	Fixed Mylar
C413	.001μf	1KV	10%	Fixed Ceram
C414	220pf	500V	5%	Fixed Mica
C415	4.7μf	10V		Fixed Lytic
C501	.01μf	500V	20%	Fixed Ceram
C502	.01μf	500V	20%	Fixed Ceram
C503	1000μf	50V	250-15	Fixed Lytic
C505	6.8μf	35V	10%	Fixed Tant
C506	1000μf	50V	250-15	Fixed Lytic

Capacitors

C508	.1μf	200V	10%	Fixed Mylar
C509	6.8μf	35V	10%	Fixed Tant
C510	.1μf	200V	10%	Fixed Mylar
C511	.1μf	200V	10%	Fixed Mylar
C512	.1μf	200V	10%	Fixed Mylar
C513	.01μf	500V	20%	Fixed Ceram
C514	10μf	64V		Fixed Lytic
C515	.047μf	200V	10%	Fixed Mylar
C516	200pf	500V	5%	Fixed Mica
C517	32μf	64V		Fixed Lytic
C518	10μf	64V		Fixed Lytic
C519	10μf	64V		Fixed Lytic
C520	32μf	64V		Fixed Lytic
C521	.1μf	200V	10%	Fixed Mylar

Transformer

T501 Power WILTRON No. 320-17A

Inductors

L301 50mh 310-4
L302 1.17mh 310-6

Transistors

Q101A	2N3566	Q207	2N4249
Q101B	2N3566	Q208	2N3566
Q102	2N3565	Q209	2N3569
Q103	2N3565	Q210	2N4249
Q104	2N4303	Q211	2N4249
Q105	2N3565	Q301	2N3565
Q106	2N3694	Q302	2N3565
Q107	2N3565	Q303	2N3565
Q108	2N3566	Q304	2N3565
Q109	2N3566	Q305	2N4045
Q110	2N3566	Q306	2N4249
Q111	2N3644	Q307	2N4249
Q112	2N3644	Q308	2N3694
		Q309	2N3565
Q201	2N3566	Q310	2N4249
Q202	2N3569	Q401	2N4249
Q203	2N4045	Q402	2N4249
Q204	2N3565	Q403	2N3565
Q205	2N3565	Q404	2N3694
Q206	2N4249	Q405	2N4390
Q406	2N3565	Q506	μa709
Q407	2N3565	Q507	2N3055
Q408	MM4002	Q508	2N4355
		Q509	2N3569
Q410	40313	Q510	2N3569
Q411	40354	Q511	TD100
Q412	40354	Q512	2N2218
Q413	2N4249	Q513	2N4249
Q414	2N4249	Q514	2N3565
		Q515	2N3565
Q501	2N3055	Q516	2N4249
Q502	2N4355		
Q503	2N3569		
Q504	2N3569		
Q505	TD100		

Diodes

CR101	1N458A	CR406	1N4383
CR102	1N458A	CR407	1N4446
CR103	1N458A	CR408	1N4446
CR104	1N4446	CR409	1N4446
CR105	FD300	CR410	1N4446
		CR411	1N4446
CR106	1N4446	CR501	1N4383
CR107	1N4446	CR502	1N4383
CR108	1N4446	CR503	1N4383
		CR504	1N4383
CR201	1N483B	CR505	1N4383
CR202	1N483B	CR506	1N4383
CR203	1N483B	CR507	1N4383
CR204	1N483B	CR508	1N4383
		CR509	1N4446
CR301		CR510	1N4446
		CR511	1N4446
CR303	1N4446	CR512	1N4749
CR304	1N4446	CR513	1N4446
CR305	1N4446	CR514	1N4446
		CR515	1N4446
CR306	1N4446		
CR307	1N4446	CR516	1N4446
CR309	1N4446	CR517	1N4446
C4310	1N4446	CR518	1N4446
		CR519	1N823
CR401	1N4446	CR520	1N4446
CR402	1N4446		
CR403	1N4446	CR521	1N823
CR404	1N4446	CR523	1N4446
CR405	1N4383		

Switches

S101	Rotary	Wiltron No. 410-53
S102	Rotary	Wiltron No. 410-47
S103	Push button	Wiltron No. 430-11
S104	Rotary	Wiltron No. 410-36
S201	Rotary	Wiltron No. 410-34
S301	Rotary	Wiltron No. 410-47
S302	Rotary	Wiltron No. 410-47
S401	Rotary	Oak No. 399430-K
S501	Push button	Wiltron No. 430-10
S502	DPDT Slide	Wiltron No. 430-9
S11	SPST	Wiltron No. 420-5
S12	SPST	Wiltron No. 420-5
S13	SPST	Wiltron No. 420-5
S14	SPST	Wiltron No. 420-5
S15	SPDT	Wiltron No. 420-6
S16	SPDT	Wiltron No. 420-6

Miscellaneous

Mixer Load Assy. 610B-S-1102
Printed Card Socket - Wiltron No. 551-7
610B-1A thru 610B-6A

DS401 WILTRON No. 632-11
DS501 Type NE2J
F501 .8 SLO BLO WILTRON No. 631-6
P501 Power Cord WILTRON No. 800-21

3 Pointed Mechanical Dial System 610B-ML-28
INTERNAL DETECTOR Wiltron Model 61D-1
Birdie Marker Mixer Assembly -
No. 610B-MS-400

Connectors

J101	510-5
J102	510-5
J103	701-4 Barrier Terminal
J104	510-5 BNC Connector
J108	510-5
J401	520-7 Connector 510-7

REMOTE OR SWEPT FREQUENCY PROGRAMMING

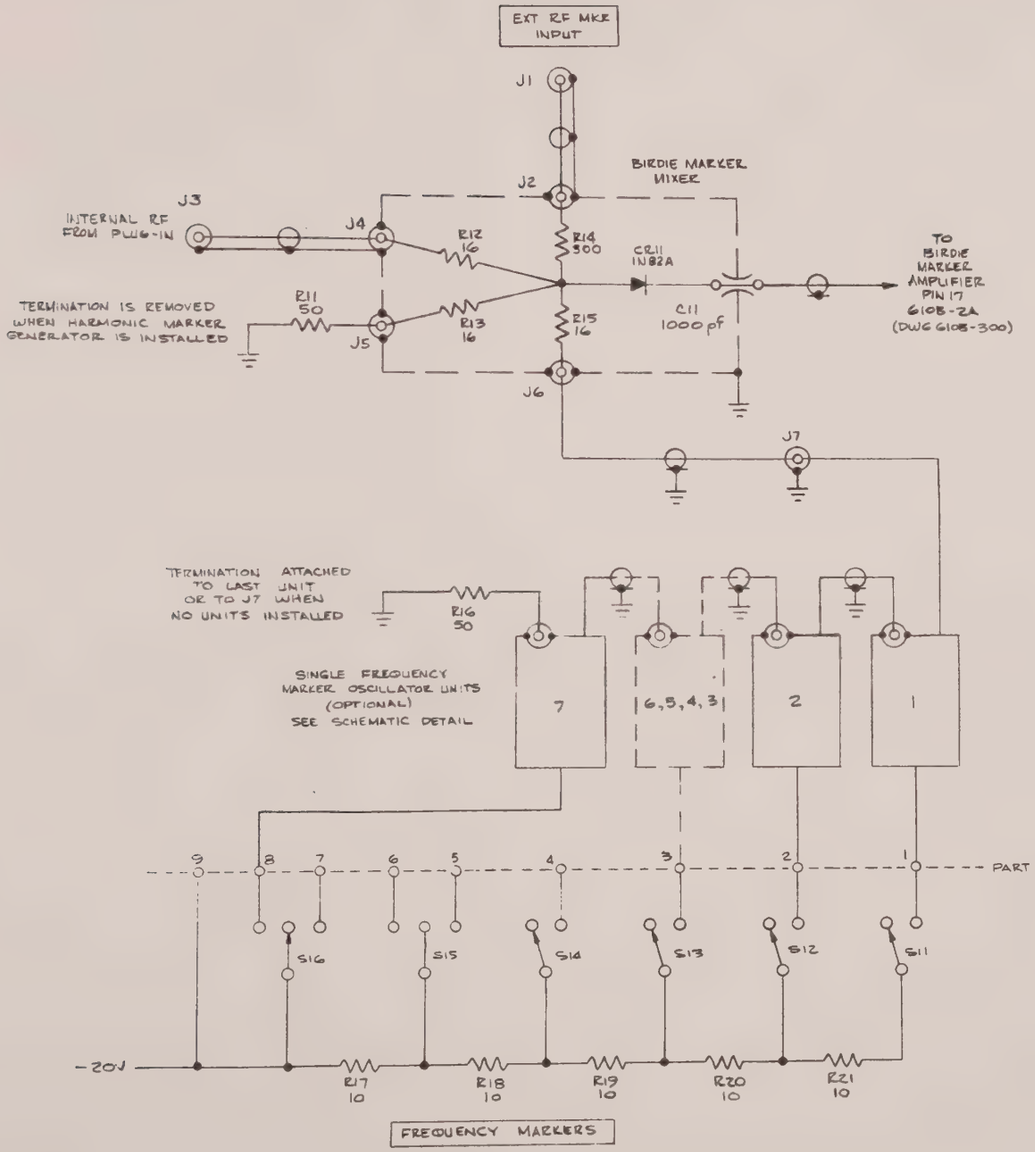
610B REAR PANEL

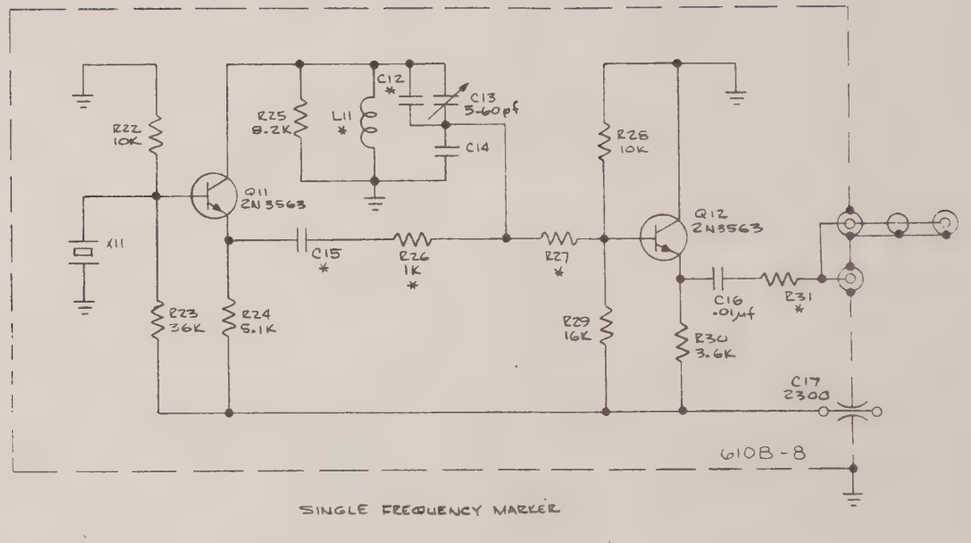
ΔF
50K
F_o
10K
REMOTE
10K
I H G F E D C B A
115/230V
50-400 Hz
EXTERNAL TRIGGER
BLANKING OUTPUT
SWEEP
INPUT 1
+5.6V
+11.2V
INPUT 2
OUTPUT
+10.6V
HARMONIC MARKER GENERATOR
MARKER OSC
MARKER OSC
MARKER OSC
50Ω TERM
ISOLATION AMPLIFIER
REGULATED POWER SUPPLIES
MIXER
MARKER VIDIO AMPLIFIER
VAR FREQ MARKER GENERATOR
SWEEP DWELL
RF PIP
INTENSITY
VIDEO
J401
P801
24
19
18
6
SWEEP TO PLUG-IN
LEVEL CONTROL REFERENCE
LEVEL DETECTOR OUTPUT
LEVEL REGULATOR OUTPUT
PLUG-IN UNIT
LEVEL REGULATOR AND MODULATION SELECTOR
FREQUENCY INSTRUCTIONS
SWEEP DRIVER
SWEEP GENERATOR
DETECTOR
610B FRONT PANEL
RF OUT
EXT RF MARKER
EXT INPUT
MODULATION
FREQ SELECTOR
F1
VAR FREQ MARKER
F2
RF IN
FROM EXT DET
VERT OUT
HORIZ OUT
SWEEP TIME
SWEEP MODE

610B FLOW DIAGRAM

610B FLOW DIAGRAM

PRINT: 6-69





SINGLE FREQUENCY MARKER

UNLESS OTHERWISE NOTED:
RESISTANCE IN OHMS
CAPACITANCE IN
INDUCTANCE IN

PRINT: 6-69

BIRDIE MARKERS

610B-001
6-13-68

BIRDIE MARKERS

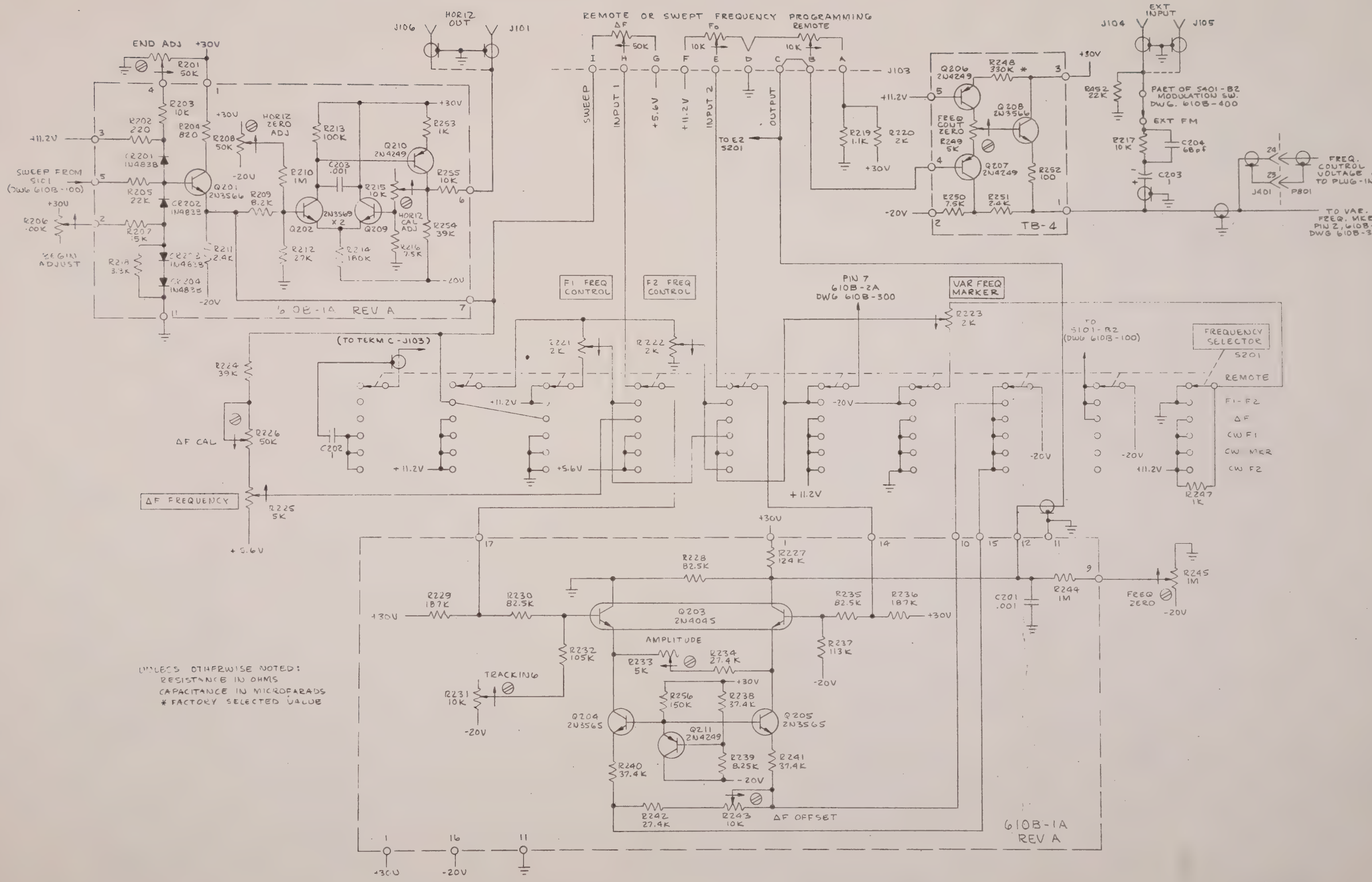
BLANKING J102
+30V PULSE DURING RETRACE
1KC BLANKING INPUT FROM PIN 12, 610B-4A (DWG 610B-400)
+30V
610B-3B
BLANKING +
TO R447 (DWG 610B-400)
TO PIN 10 610B-2A (DWG 610B-300)
J401 PIN 3
TO PIN 17, 610B-4A LEVEL REGULATOR (DWG 610B-400) AND TO R327 VAR FREQ MKR AMP (DWG 610B-300)
BLANKING -
J401 PIN 15
RETRACE RF
S104 OFF ON
+30V
-20V
EXT TRIG ADJ
SWEEP MODE
SWEEP TRIGGER
J701
TRIGGER
MANUAL
LINE SYNC
AUTO
60 Hz FROM T501 TERMINALS (DWG 610B-500)
S101A2
C101 .1
R101 10K
R150 10K
CR101 IN458A
CR102 IN458A
C103 .001
CR103 IN458A
C104 .001
R102 1.2K
R103 10K
R104 9.1K
R105 6.8K
R106 910
Q101A 2N3566
Q101B 2N3566
Q102 2N3565
R107 10K
R108 27K
R109 10K
R110 100K
R111 56K
R112 13K
R113 43K
R114 5.6K
R115 27K
* R116 360K
C105 68pf
Q103 2N3565
CR105 ED300
CR104 IN4446
R122 3.3K
R123 10K
R124 470K
Q104 2N4303
Q105 2N3565
Q106 2N3694
C106 .001
R125 4.7K
R126 10K
R129 47K
SWEEP BIAS ADJUST
R127 5K
R128 4.7K
SWEEP START LEVEL
+30V
R143 39K
R144 50K
MANUAL SWEEP
R146 180
R147 56K
R148 10K
R149 27K
R141 4.7K
Q108 2N3566
C116 7PF
R117 36K
C117 7PF
R120 5.6K
CR107 IN4446
R121 1.5K
Q111 2N 3644
C118 51Pf
R145 27K
C119 7Pf
Q112 2N3644
CR108 IN4446
Q109 2N3566
R118 2K
R119 36K
Q110 2N3566
R142 36K
S104 OFF ON
S101 B2
FROM S201-A2 (DWG 610B-200)
TRIG
MANO
L.SYNC
AUTO
C102 5 pf
R136 8.2M
S102 SWEEP TIME
C107 2 µf
C108 .2 µf
C109 .02 µf
C110 .002 µf
C111 50 µf
C112 5 µf
C113 .47 µf
C114 .047 µf
J401 PIN 8
SEE 610B-300
R134 100K
SWEEP VERNIER
R135 6.8K
S103
TRIGGER
-20V
S101 B1
SWEEP TO PIN 5 610B-1A (DWG 610B-200)
R130 7.5K
R131 5K
SWEEP END LEVEL
R132 4.7K
R133 7.5K
R139 10K
R138 10K
TRIGGER ADJ
S101-A1
TRIGGER
MANUAL
LINE SYNC
AUTO
R140 18K
CR106 IN4446
C115 .02
Q107 2N3565
R137 * 150K
HOLD OFF ADJ
R152 10K
R151 10K
610B-3B SWEEP GENERATOR
SWEEP GENERATOR

UNLESS OTHERWISE NOTED:
RESISTANCE IN OHMS
CAPACITANCE IN MICROFARADS
* FACTORY SELECTED VALUE

PRINT: 6-69

SWEEP GENERATOR

610B-100
8-7-69



PRINT: 6-69

FREQUENCY INSTRUCTION

610B-200
11-3-69

610B-2A
REV A

NARROW
WIDE
S301
BIRDIE MARKERS
C305 32
+30V
R307 1K
R306 6.8K
R304 100K
R305 20K
R309 100
R310 2K
C309 32
C308 .01
C306 .01
Q302 2N3565
R354 15K
R301 100K
L301 50mh
C303 .05
R308 1.5K
L302 1.17mh
C304 2000pf
Q301 2N3565
C302 .01
C301 .001
R302 15K
R303 2.2K
C307 32
FROM BIRDIE MARKER MIXER C111 (DWG 610B-001)
BIRDIE MARKER AMPLITUDE
R311 100K
INTERNAL DETECTOR
RF IN
R315 47K
R314 180K
R351 47K
J108
VERT OUT
J107
J109 FROM EXTERNAL DETECTOR
C313 270pf
C311 270pf
R312 47K
Q303 2N3565
Q304 2N3565
R349 82K
R332 47K
R333 39K
R334 12K
R350 100K
C315 .01
-20V
R335 56K
BLANKING OUT FROM PIN 10 610B-38 (DWG 610B-100)
C314 .01
R336 2.2K
MAX AMPL ADJ
R326 10K
R325 12K
R345 100K
-5.6V PIN 8
R327 100K
BLANKING PIN 17 610B-38
VAR FREQ MKR AMP
FROM PIN 1 TB4 (DWG 610B-200)
R320 300K
R321 300K
Q306 2N4249
Q307 2N4249
CR309 IN4446
CR310 IN4446
R316 82.5K
CALIBRATE
R317 10K
R318 174K
Q305 2N4045
CR303 IN4446
CR304 IN4446
R322A
R322 10K
BALANCE
R323 200K
C312 47pf
R324 62K
-20V
R246 47
S201 C2
S201 A2
DWG 610B-200
R223 2K
VAR FREQ MARKER
CR305 IN4446
CR306 IN4446
R328 20K
R329 20K
R330 390K
Q308 2N3694
R331 10K
-20V
RF PIP
S302
VIDEO
INTENSITY
VAR FREQ MARKER
CR307 IN4446
J401
P801
TO POWER LEVEL CONTROL IN PLUG-IN
SWEEP VERNIER DWG 610B-100
R135 6.8K
R134 100K
R339 470K
Q309 2N3565
Q310 2N4249
R337 10K
R338 20K
R340 24K
R341 10K
R342 20K
R343 82K
R344 4.7K
DWELL ADJUST
-20V
610B-2A
REV A
R347 10K
VARIABLE MARKER OUT (OPTION)
J110

UNLESS OTHERWISE NOTED:
RESISTANCE IN OHMS
CAPACITANCE IN MICROFARADS
INDUCTANCE IN MILLIHENRIES

PRINT: 6-69

VARIABLE AND BIRDIE MARKERS

610B-300
4-14-69

VARIABLE AND BIRDIE MARKERS

RF POWER LEVEL CONTROL

TO LEVEL DETECTOR

TO LEVEL ATTEN

NETWORK

P801 J401 PLUG-IN MODEL 610B

R446 39K

R447 6.8K

-20V

CR407 IN4446

MARKER FROM CR307

BLANKING + FROM PIN 15 610B-3A

EXT LEVELING ADJ

R454 1K

R402 50K

R403 1.5K

C401 6.8

C402 6.8

J105 EXTERNAL INPUT

J104

S401

R452 22K

C407 .0047

R401 10K

MODULATION

NORMAL

INT AM

EXT AM

EXT FM

PWR MTR

XTAL

A1 B1 B2 C2 A2

R455 91K

C412 .1

C204 68pf

R404 1K

R405 10K

C415 47

R458 1K

-20V

PIN 1 TB4 (DWG 610B-200)

C203

R217 10K

+30V

R406 100K

R407 150K

LEVEL BALANCE

R408 1K

C404 .1μf

R411 1K

Q401 2N4249

Q402 2N4249

C405 47pf

R410 15K

Q403 2N3565

R409 270K

Q413 2N4249

Q414 2N4249

R456 680

R448 68K

R412 33K

R449 68K

LEVEL REGULATOR AMPLIFIER

R415 36K

CR401 IN4446

R416 5.1K

Q404 2N3694

R414 68K

R417 15K

C408 .001

R413 330

R450 330K

LIMIT SENSOR

C414 220pf

R420 120K

Q405 2N4390

R421 100K

R422 270K

C406 .001

CR402 IN4446

R419 1K

R418 10K

UNLEVELED IF LIGHTED

DS401

BLANKING - FROM PIN 17 610B-3A (DWG 610B-100)

610B-4B REV A

+30V

R424 9.1K

C409 .033

R425 56K

CR403 IN4446

R426 9.1K

R453 6.2K

R423 2.2K

R427 1M

R428 10K

CR409 IN4446

R429 2K

R457 47K

1 KHz FREQ ADJ

Q406 2N3565

Q407 2N3565

C410 .033

R431 9.1K

R430 150K

CR408 IN4446

R432 130K *

CR404 IN4446

R433 15K

R434 5.1K

-20V

TO PIN 14 610B-3A DWG 610B-100

1 KHz INTERNAL AM OSCILLATOR

18 11

-20V

PART OF T501

CR405 IN4383

CR406 IN4383

C411A 80

R451 120K

+30V

15

R435 15

Q408 MM4002

Q408 2N3988

R439 2.4K

Q410 40313

R438 47

R441 200K

C413 .001

R440 120K

-20V

+30V

Q411 40354

CR410 IN4446

CR411 IN4446

R445 62K

Q412 40354

R442 15K

R443 110K

R444 30K

J401 P801

C411B 50

+30V

HV +40V TO +140V

R801 *

PROGRAMS HV FOR PLUG-IN

610B-4B REV A

PROGRAMMABLE HIGH VOLTAGE REGULATOR

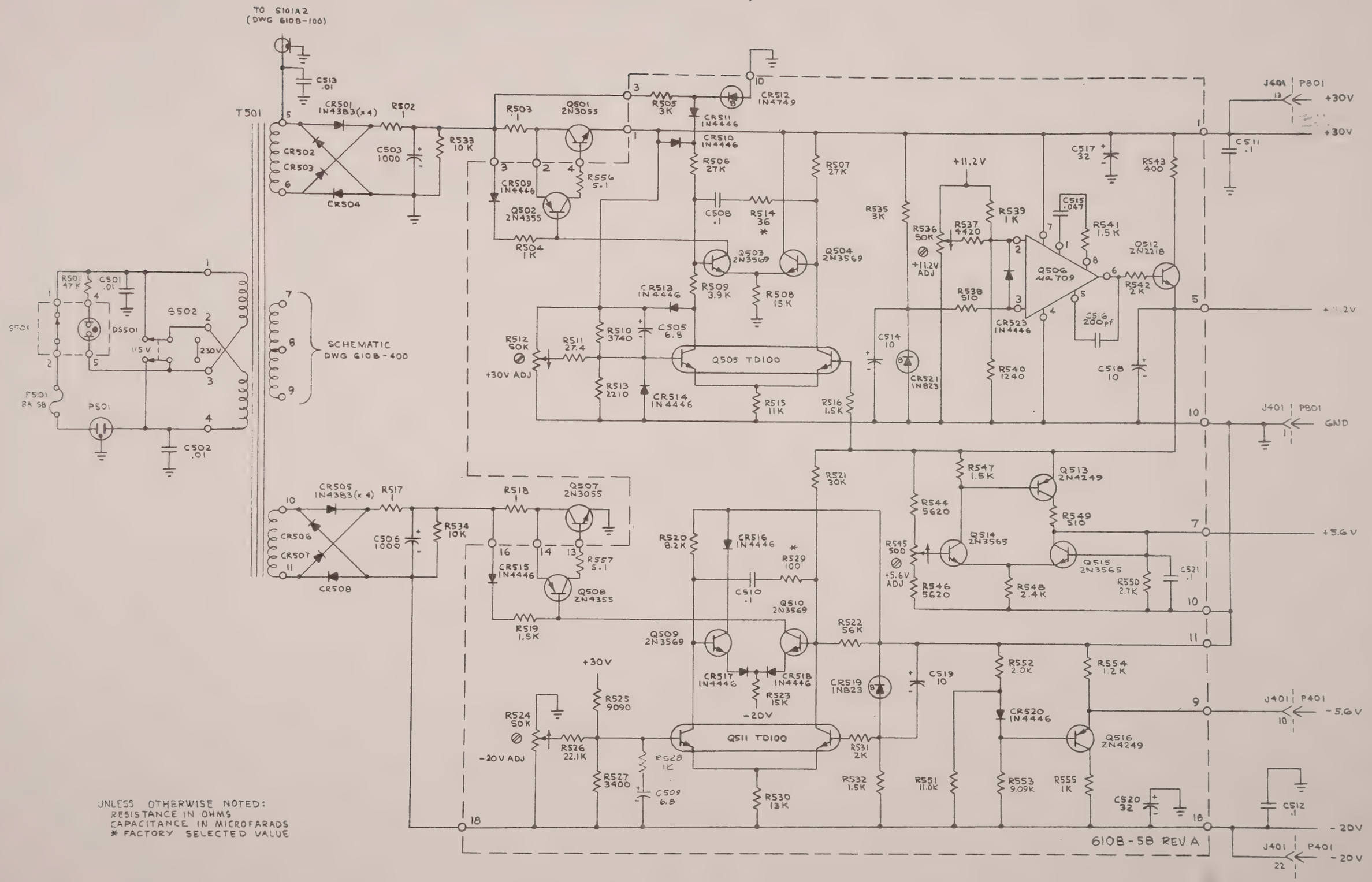
UNLESS OTHERWISE NOTED:
RESISTANCE IN OHMS
CAPACITANCE IN MICROFARADS

LEVEL REGULATOR AND HIGH VOLTAGE REGULATOR

LEVEL REGULATOR AND HIGH VOLTAGE REGULATOR

PRINT: 6-69

610B-400
2-27-70



UNLESS OTHERWISE NOTED:
RESISTANCE IN OHMS
CAPACITANCE IN MICROFARADS
* FACTORY SELECTED VALUE

Resistors

R901	27K	1/4W	5%	Fixed	Comp
R902	2.2K	1/4W	5%	Fixed	Comp
R903	27K	1/4W	5%	Fixed	Comp
R904	4.3K	1/4W	5%	Fixed	Comp
R905	1K	1/4W	5%	Fixed	Comp
R906	100	1/4W	5%	Fixed	Comp
R907	3.3K	1/4W	5%	Fixed	Comp
R908	4.7K	1/4W	5%	Fixed	Comp
R909	4.7K	1/4W	5%	Fixed	Comp
R910	100	1/4W	5%	Fixed	Comp
R911	3.3K	1/4W	5%	Fixed	Comp
R912	470	1/4W	5%	Fixed	Comp
R913	470	1/4W	5%	Fixed	Comp
R914	1K	1/4W	5%	Fixed	Comp
R915	430	1/2W	5%	Fixed	Comp
R916	1K	1/4W	5%	Fixed	Comp
R917	47	1/8W	5%	Fixed	Comp
R919	30K	1/4W	5%	Fixed	Comp
R920	27K	1/4W	5%	Fixed	Comp
R921	2.2K	1/4W	5%	Fixed	Comp
R922	27K	1/4W	5%	Fixed	Comp
R923	4.3K	1/4W	5%	Fixed	Comp
R924	10K	1/4W	5%	Fixed	Comp
R925	10K	1/4W	5%	Fixed	Comp
R926	51	1/4W	5%	Fixed	Comp
R927	1K	1/4W	5%	Fixed	Comp
R928	39K	1/4W	5%	Fixed	Comp
R929	39K	1/4W	5%	Fixed	Comp
R930	390K	1/4W	5%	Fixed	Comp
R931	1.5M	1/4W	5%	Fixed	Comp
R951	4.7K	1/4W	5%	Fixed	Comp
R952	2.2K	1/4W	5%	Fixed	Comp
R953	150	1/4W	5%	Fixed	Comp
R954	33	1/4W	5%	Fixed	Comp
R955	2.2K	1/4W	5%	Fixed	Comp
R956	150	1/4W	5%	Fixed	Comp
R957	2.2K	1/4W	5%	Fixed	Comp
R958	4.7K	1/4W	5%	Fixed	Comp
R959	2.2K	1/4W	5%	Fixed	Comp
R960	100	1/4W	5%	Fixed	Comp

Capacitors

C901	5-60pf			Var	Mica
C902	180pf	500V	10%	Fixed	Mica
C903	1μf	35V	10%	Fixed	Tant
C904	39pf	500V	5%	Fixed	Mica
C905	1500pf	125V	5%	Fixed	Poly

Capacitors

C906	33pf	500V	5%	Fixed	Mica
C907	51pf	500V	5%	Fixed	Mica
C908	10pf	500V	5%	Fixed	Mica
C909	1μf	35V	10%	Fixed	Tant
C910	1000pf	500V	feed thru	Fixed	Ceram
C911	68pf	500V	feed thru	Fixed	Ceram
C912	1pf	500V	5%	Fixed	Ti02
C913	2-18pf	500V		Var	Mica
C914	1μf	35V	10%	Fixed	Taut
C915	7pf	500V	5%	Fixed	Mica
C916	43pf	500V	5%	Fixed	Mica
C917	15pf	500V	5%	Fixed	Mica
C918	1μf	35V	10%	Fixed	Tant
C919	2300pf	500V	feed thru	Fixed	Ceram
C920	2300pf	500V	feed thru	Fixed	Ceram
C921	2300pf	500V	feed thru	Fixed	Ceram
C922	2300pf	500V	feed thru	Fixed	Ceram
C923	2300pf	500V	feed thru	Fixed	Ceram
C924	51pf	500V	5%	Fixed	Mica
C925	150pf	500V	5%	Fixed	Mica
C951	.001μf	1KV	10%	Fixed	Ceram
C952	.001μf	1KV	10%	Fixed	Ceram
C953	2-20pf	1KV	10%	Var	Ceram
C954	.001μf	1KV	10%	Fixed	Ceram
C955	51pf	500V	5%	Fixed	Mica
C956	.68pf	500V	5%	Fixed	Ti02
C957	10pf	500V	5%	Fixed	Mica
C958	5pf	500V	10%	Fixed	Mica
C959	2-20pf	500V		Var	Ceram
C960	.001μf	1KV	10%	Fixed	Ceram
C961	.001μf	1KV	10%	Fixed	Ceram
C962	.001μf	1KV	10%	Fixed	Ceram

Transistors

Q901	2N3565	Q906	2N3563
Q902	2N3646	Q951	2N3563
Q903	2N3646	Q952	2N3563
Q904	2N3563	CR901	FDH600
Q905	2N3563	CR902	0114

Inductors

L901	100μh	Fixed	L951	Fixed
L902	10μh	Fixed	L953	Fixed

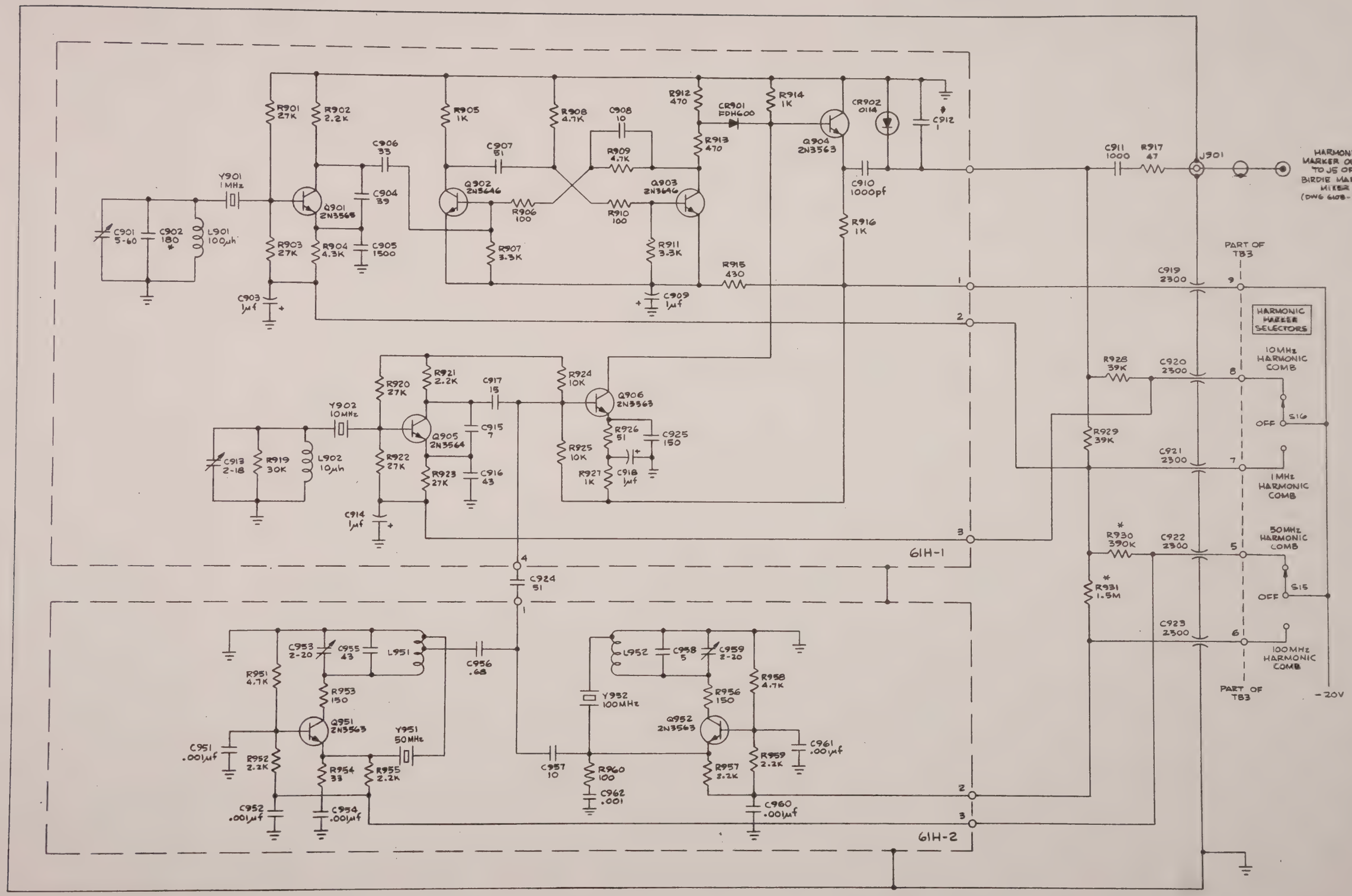
Crystals

Y901	1 MHz	Crystal	Y951	50 MHz	Crystal
Y902	10 MHz	Crystal	Y952	100 MHz	Crystal

Connectors

J901 MX-1684A/U

23 June 1969



UNLESS OTHERWISE NOTED:
RESISTANCE IN OHMS
CAPACITANCE IN PICOFARADS
* FACTORY SELECTED VALUE

PRINT: 9-68

1, 10, 50 & 100 MHz HARMONIC MARKER GENERATOR MODEL 61HH

610B-950HH
7-16-68

1, 10, 50 & 100 MHz HARMONIC MARKER GENERATOR MODEL 61HH

MODEL 6108

PLUG-IN (10 MHz - 1000 MHz)

INSTRUCTION MANUAL

TABLE OF CONTENTS
(Also see 610B MANUAL)

THEORY OF OPERATION — SECTION 1

1-1 GENERAL
1-2 R. F. GENERATOR AND LEVELER
1-3 FREQUENCY CONTROL
1-4 550 - 1000 MHz BAND
1-5 10 - 550 MHz BAND

RECALIBRATION PROCEDURE — SECTION 2

2-1 INPUT REQUIRED FROM THE 610B MAIN FRAME
2-2 6108 MECHANICAL INSPECTION
2-3 FREQUENCY CONTROL RECALIBRATION
2-4 LEVEL CONTROL RECALIBRATION
2-5 FREQUENCY CONTROL ADJUSTMENTS
2-6 LEVEL CONTROL ADJUSTMENTS
2-7 6108 TROUBLE SHOOTING GUIDE

PARTS LIST — SECTION 3

SCHEMATICS and FLOW DIAGRAM — SECTION 4

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WILTRON COMPANY
for better electronics measurements

930 EAST MEADOW DRIVE
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SECTION 1

MODEL 6108 PLUG-IN
THEORY OF OPERATION

1-1 GENERAL

The Model 6108 divides the 10 to 1000MHz spectrum into two bands. The top band functions as a direct oscillator covering 550 to 1000 MHz. The lower band uses the heterodyne technique to generate 10 to 500 MHz which is amplified to deliver 1v rms at the output. Both bands utilize the same voltage controlled oscillator, isolation amplifier and PIN diode leveling attenuator. A coaxial switch makes the necessary circuit changes for band switching as shown in the 6108 flow diagram. A portion of the output is extracted for the birdie mixer.

1-2 R.F. GENERATOR AND LEVELER

The voltage controlled oscillator is a packaged transistor oscillator covering the range 550 to 1155 MHz for a control voltage of -1.5 to +60 volts. The output is link coupled to the isolation amplifier, Q602 of schematic 6108-600. The transistor Q601 acts as a saturating switch to provide collector voltage for the oscillator. For R.F. off during retrace the blanking signal opens the switch and no R.F. is generated. The isolation amplifier feeds an attenuator with one PIN diode in series and another in shunt. This configuration gives a wide dynamic range and maintains a good match so that the oscillator frequency does not change as the signal level is varied. A fixed bias current is provided by R625 which supplements the variable current from the emitter follower Q603. The base voltage of Q603 is near -18 volts for minimum attenuation and near 0 volts for maximum.

1-3 FREQUENCY CONTROL

The frequency control circuit shapes the input 10 volt ramp to a non-linear output of 60 volts in the manner described in the 610B theory of operation. The control loop will handle fm rates up to 3kHz, falling rapidly beyond this to the loop crossover frequency of 50 kHz. The shaping establishes the relation 0 to +10 volts input for 550 to 1155 MHz output. A divider at the input is controlled by the bandswitch, S601, so that the input 10 volt ramp becomes 0 to 7.4 to generate the high band and 0.91 to 10 to sweep the low band. See schematic 6108-800.

1-4 550-1000 MHz BAND

For this band the R.F. signal from the leveler is connected through a 1000MHz low-pass filter and a 10db directional coupler to the output terminal. The filter removes all harmonics and the coupler samples the incident energy which is detected and used for leveling. This establishes the 50 ohm output impedance. The level regulator amplifier (see 610B Theory of Operation) controls Q603 which drives the PIN diode leveler.

1-5 10-550 MHz BAND

The output of the leveler is switched to a 1155 MHz low-pass filter feeding a doubly balanced mixer. A high level fixed 605MHz signal from the oscillator Q861, see schematic 6108-800, is fed to the other mixer input. The difference frequency 0 to 550MHz is coupled through a 550 MHz low-pass filter to the power amplifier of schematic 6108-700.

10-550 MHz Band - cont'd.

This amplifier consists of five cascaded common emitter stages followed by a feedback pair which delivers 2 v rms to R737. A divider R735, 736 couples this same signal to the detector CR701, for leveling. The leveling action keeps the voltage constant at the top of R735 thus creating a zero impedance source.

The 49.9 ohm series resistor, R737, establishes the 50 ohm output impedance and reduces the output level to 1v rms. A single R.F. Power Level control sets the level reference voltage for either band since the low band level detector is attenuated to agree with the high band for large output levels as shown in schematic 6108-600. The level loop follows modulation to above 10 kHz and then rolls off rapidly to a loop crossover at about 200 kHz.

SECTION 2

6108 PLUG-IN
RECALIBRATION PROCEDURE

2-1 INPUT REQUIRED FROM THE 610B MAIN FRAME

In order to have an accurately calibrated plug-in unit, the input voltages and waveforms from the 610B Main Frame must be correct. The table on the next page lists the important voltages and waveforms found at J401, the input to the plug-in located on the 610B rear panel. If the signal is incorrect or out of tolerance, the reference given along with each signal directs the operator to the appropriate section of the Recalibration Procedure. As a further aid in Recalibration, simplified signal flow diagrams (Fig. 2 D and 2 E) are given with the major stages of the 6108 and the important voltages and waveforms indicated. Prior to checking the inputs from the Main Frame, make the front panel control settings as indicated in the opposite column. Allow 15 minutes warm-up time before making any measurements or adjustments.

610B/6108 FRONT PANEL CONTROL SETTINGS

FREQUENCY SELECTOR F1 to F2

RETRACE RF - OFF

F1 Frequency Control - 0

F2 Frequency Control - 1000 MHz

SWEEP MODE - AUTO

SWEEP TIME - 1.0 - 0.1 sec.

SWEEP TIME VERNIER - FULL CW

MODULATION - NORMAL

VAR FREQ MARKER - INTENSITY

VAR FREQ MARKER AMP - FULL CCW

RF POWER LEVEL - MAX

FREQUENCY BAND - HIGH

Recalibration Procedure - cont'd.

TABLE 2A

c) Voltages and Waveforms on J401 with the 610B/6108 front panel controls set as indicated on the previous page.

PIN NO.	VOLTAGE OR WAVEFORM	RECALIBRATION REFERENCE
2	PROGRAMMED HIGH VOLTAGE, +95 V d.c. ±5%	610B Section 7-2
6	Level control voltage -10 to -17 V d.c. nominal range +2 to -18 V d.c. maximum range	610B Section 7-7
10	-5.6 V d.c.	610B Section 7-2
13	+30 V d.c. ±10 mv	610B Section 7-2
15	Negative blanking to VCO +30 during sweep, 0 during retrace	610B Section 7-17
16	External level control reference voltage -0.1 V to -0.3 V d.c. nominal range	6108 Section 2-7
18	Level Detector Output Voltage -0.2 V to -0.4 V d.c. nominal range	6108 Section 2-3
19	Level Regulator Reference Voltage -0.1 V to -0.3 V d.c. nominal range	6108 Section 2-3
22	-20 V d.c. ±10 mv	610B Section 7-2
24	Sweep Waveform, See Fig. 7C	610B Section 7-5

Recalibration Procedure - cont'd.

2-2 6108 MECHANICAL INSPECTION

a) To obtain the best performance from the 6108, all covers should be securely attached to their subassemblies and the subassemblies mounted to the 6108 Frame.

NOTE: The cover screws on the Voltage Controlled Oscillator and the Mixer subassemblies are sealed with gliptal and should not be tightened or loosened; adjustment of these screws will cause a deterioration of the 6108 overall performance.

b) Check to see that all BNC connections are tight and that there are no broken or chaffed wires in the plug-in.

c) Take special care to see that the 5-500 MHz R.F. AMPLIFIER is securely mounted to the 6108 main deck and that its cover is screwed on and grounded to the braiding on the main deck.

2-3 FREQUENCY CONTROL RECALIBRATION

a) If there is any question as to the R.F. frequency being observed, the operator should refer to Section 3 of the 610B Instruction Manual for Frequency Measurement Procedures.

b) Set FREQUENCY SELECTOR-CWF1. Set all other Front Panel controls as described in Section 2-1, Column 2. With the F1 Frequency Control set exactly on 550 MHz, check the R.F. frequency output for 550MHz ±5 MHz.

c) Set FREQUENCY SELECTOR-CWF1
FREQUENCY BAND - LOW
F1 Frequency Control - 10 MHz

Set all other Front panel controls as described in Section 2-1, Column 2. With the F1 Frequency Control set exactly on 10 MHz, check the R.F. output for 10 MHz ±5 MHz.

d) If either of the frequencies measured in Steps b and c above are out of tolerance, see Section 2-5 for the Adjustment Procedures.

2-4 LEVEL CONTROL RECALIBRATION

Set all Front Panel controls as described in Section 2-1, Column 2.

a) Connect the 610B/6108 and a d.c. coupled oscilloscope as shown in Figure 2-A. Observe the detected R.F. output on the oscilloscope. The video should appear as shown in Fig. 2-B. The video should be flat across the band ±0.3 db and the Unleveled Indication light on the 610B front panel should be off.

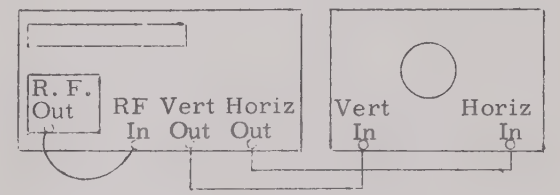


Figure 2-A
610B/6108 and D.C. OSCILLOSCOPE TEST CONFIGURATION

Turn the R.F. Power Level Control CCW to its minimum position and observe that the R.F. stays leveled and the Unleveled light stays off.

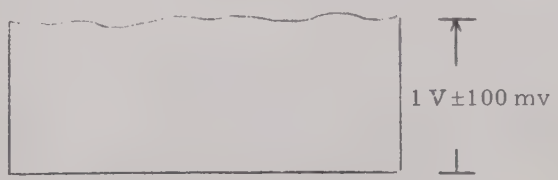


Figure 2-B
DETECTED 6108 R.F.
AS SEEN ON AN OSCILLOSCOPE

Recalibration Procedure - cont'd.

LEVEL CONTROL RECAL. -continued-

b) Turn the 6108 FREQUENCY BAND to LOW and repeat step a.

c) Connect an R.F. Power Meter to the R.F. output of the 6108.
Set RETRACE R.F. to ON.
Set all the other controls as described in Section 2-1, Column 2.
The power output of the 6108 High band should be at least +13dbm ±0.3dB.

d) Turn the 6108 FREQUENCY BAND to LOW and check that the power meter reading is the same as for the high band, ± 0.3dB.

e) If any of the measurements made in steps a through d are out of tolerance, see Section 2-6 for the Level Control Adjustments.

2-5 FREQUENCY CONTROL ADJUSTMENTS

a) Connect the 610B/6108 as shown in Figure 2-C for access to internal controls.
Set FREQUENCY SELECTOR-CWF1.
Set all other Front Panel controls as described in Section 2-1, Column 2.

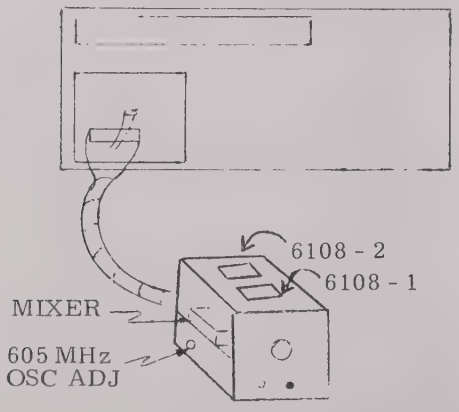


Figure 2-C
610B/6108 and EXTENDER CABLE

With the F1 control set exactly on 0 (550 on high band), adjust R811 560 MHz ADJ located on the 6108-2 Printed Card to bring the frequency of the R.F. output to 550 MHz ±2 MHz.

b) Set all Front Panel controls as described in Section 2-1, Column 2. Disconnect P610 from the mixer block assembly (center BNC connector with the small white coax cable) and connect it to the frequency measuring circuit being used. This is the output from the 605 MHz oscillator. The output from this oscillator should be 605 MHz ±1 MHz. If this frequency is out of tolerance it may be adjusted by a screwdriver adjustment on the left side of the 6108 located near rear of the instrument. See Figure 2-C for the adjustment location. Re-connect the cable to the mixer after making the adjustment.

c) Set FREQUENCY SELECTOR-CWF1. Set 6108 FREQUENCY BAND to LOW. Set all the others controls as described in Section 2-1, Column 2.

With the F1 Frequency Control set exactly on 10 MHz, adjust R853 10 MHz ADJ, located on the 6108-2 Printed Card, for an R.F. output frequency of 10 MHz ±2 MHz.

d) If it is impossible to accomplish any of the above steps, See Section 2-7 for Trouble Shooting suggestions.

2-6 LEVEL CONTROL ADJUSTMENTS

a) Check Level Control Recalibration procedure Section 7-7 in the 610B manual.

Recalibration Procedure - cont'd.

2-6 Level Control Adjustments - continued-

b) Set RETRACE R. F. to ON. Set all the other Front Panel controls as described in Section 2-1, Column 2. Connect the R.F. Power Meter to the R.F. output of the 6108. With the R.F. POWER LEVEL control turned Full CW, adjust R624 UPPER LEVEL LIMIT located on the 6108-2 PC for an output of at least +13dBm (±0.3dB).

c) Turn the 6108 FREQUENCY BAND to LOW and adjust R618 LEVEL EQUALIZE located on the 6108-2 Printed Card for the same output as in step b preceding.

d) Connect the 610B/6108 and a d.c. coupled oscilloscope as shown in Figure 2-A. With the 610B/6108 Front Panel controls set as described in Section 2-1, observe the detected R.F. signal as described in Section 2-4, (a). Check the Low band for a similar detected R.F. signal.

e) Set all controls as described in Section 2-1. Turn the R.F. POWER LEVEL CONTROL CCW to its minimum position. Adjust R619 LOWER LEVEL LIMIT until the detected R.F. just becomes unleveled and the Unleveled Indication light on the 610B Front Panel comes on. Check for this condition on both frequency bands. On the band that will stay unleveled when the other band is leveled, adjust R619 so that the detected R.F. is about 1/2 db above the point where it becomes unleveled.

f) If it is impossible to perform any of the above steps see Sec. 2-7 for Trouble Shooting suggestions.

Recalibration Procedure - cont'd.

2-7 TROUBLE SHOOTING GUIDE

The R.F. circuitry in the 6108 is carefully adjusted and tuned at the factory for optimum performance. The exact placement of wires and components is of critical importance in the 6108 and it is therefore recommended that trouble shooting of the RF circuitry be limited to isolating the problem to a stage and haveing the factory repair or replace the defective stage.

Figures 2-D and 2-E should be used as a guide in isolating problems to a single stage in the instrument.

It is assumed that the 610B Main Frame is functioning correctly. (See Table 2-A for important signals from the 610B).

TABLE 2-B

6108 TROUBLE SHOOTING GUIDE

INDICATION	POSSIBLE CAUSE and REMEDY
No. R.F. output on either band.	1. Set controls as described in Sec. 2-1 and check for voltages in Table 2-A. 2. Check for loose internal coax connector. 3. Check voltages and waveforms as shown in Figure 2-D to find defective stage. 4. Defective cable connected to R.F. OUTPUT.
No R.F. output on low band, high band okay.	1. Check signals shown in Figure 2-E to find defective stage.
Low R.F. output on band.	1. See Level Recalibration Procedure, Section 2-4. 2. Defective internal detector. 3. Check for proper signal levels as shown in Figure 2-D.
LOW BAND R. F. is unleveled; high band okay.	1. Check for loose cover or other mechanical defect. See Sec. 2-2. 2. See Level Recalibration Procedure, Section 2-4. 3. Check for proper signal levels as shown in Figure 2-E.

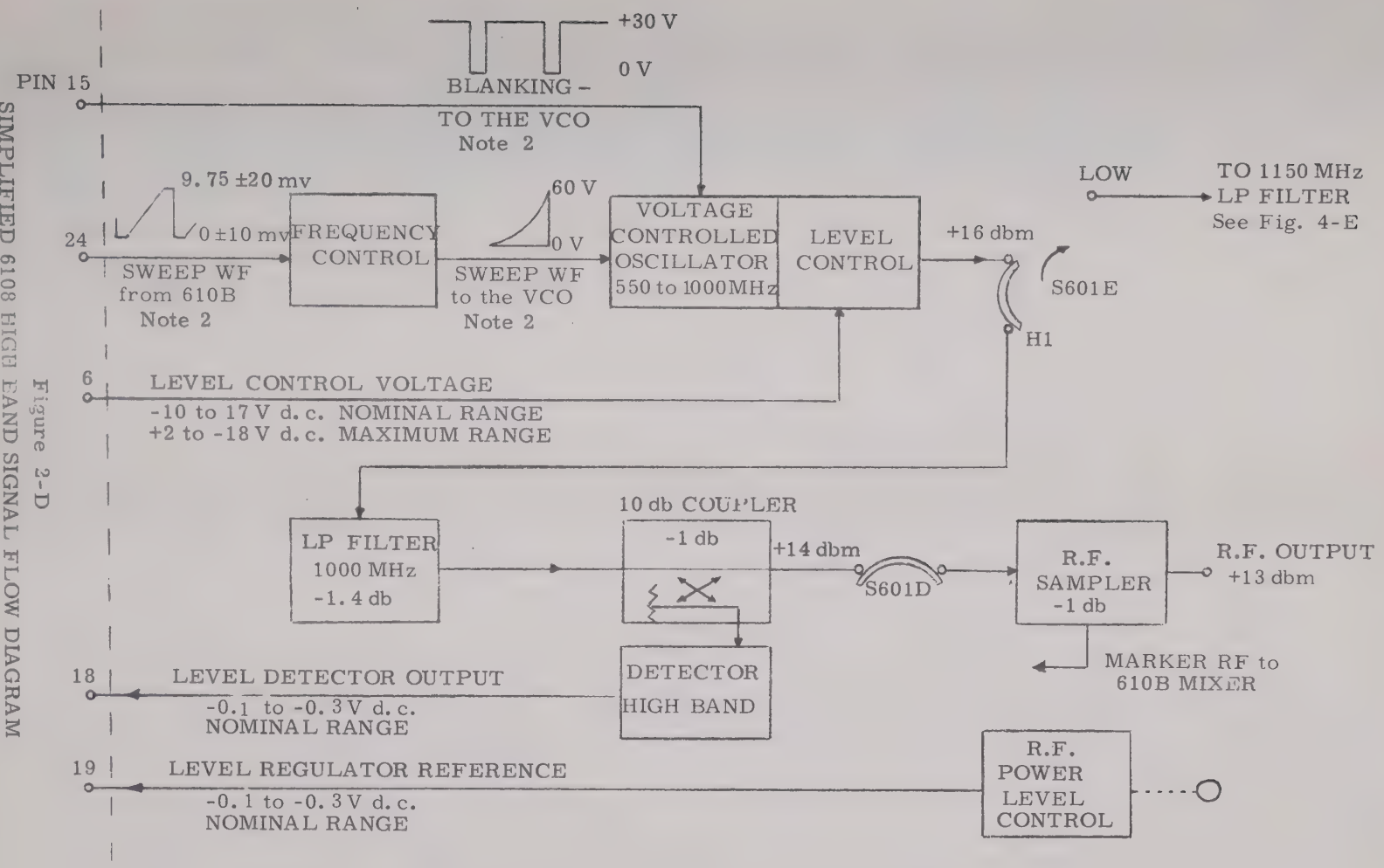


Figure 2-D SIMPLIFIED 6108 HIGH BAND SIGNAL FLOW DIAGRAM

NOTE: 1. All power readings taken at maximum power output with 610B RETRACE R.F. switch in the ON position.

2. Controls set as described in Section 2-1, Column 2.

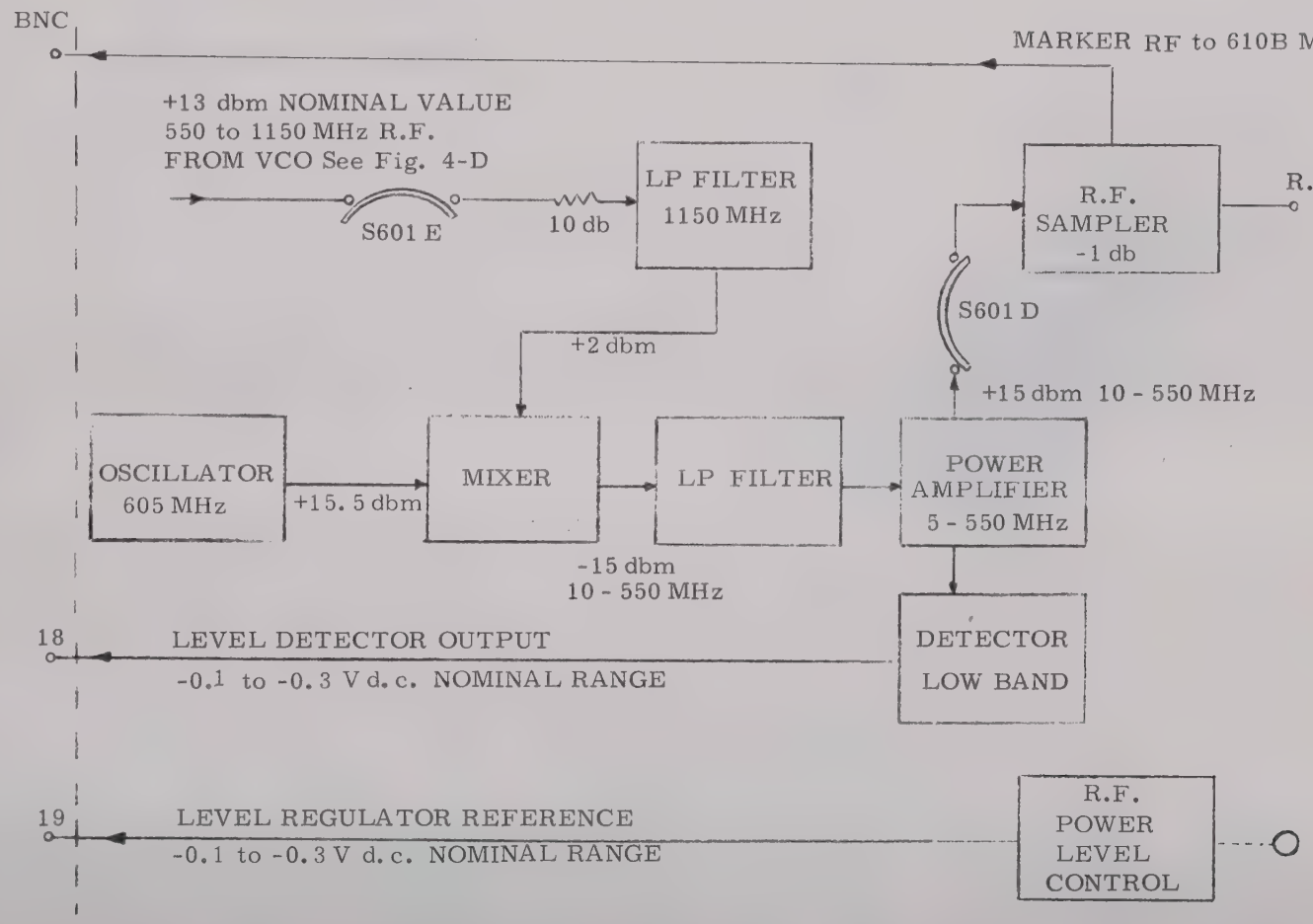


Figure 2-E SIMPLIFIED 6108 LOW BAND SIGNAL FLOW DIAGRAM

NOTE: All power readings taken at maximum power output with the 610B RETRACE R.F. switch in the ON position.

Resistors

R601	2.74K	1/8W	1%	Fixed	Film
R602	150	3W	5%	Fixed	WW
R603					
R604	220	3W	5%	Fixed	WW
R605	51	1/4W	5%	Fixed	Comp
R606	220	3W	5%	Fixed	WW
R607	270	3W	5%	Fixed	WW
R608	39	1/4W	5%	Fixed	Comp
R609	10K	1/4W	5%	Fixed	Comp
R610	7.5K	1/4W	5%	Fixed	Comp
R611	820	1/4W	5%	Fixed	Comp
R612	150	1/4W	5%	Fixed	Comp
R613	150	1/4W	5%	Fixed	Comp
R614	1K	1/4W	5%	Fixed	Comp
R615	750	1/4W	5%	Fixed	Comp
R616					
R617	2K	1/4W	5%	Fixed	Comp
R618	2K			Var	WW
R619	500			Var	WW
R620	1K			Var	WW
R621	360	1/4W	5%	Fixed	Comp
R622	470	1/4W	5%	Fixed	Comp
R623	15K*	1/4W	5%	Fixed	Comp
R624	5K			Var	WW
R625					
R626	30K	1/4W	5%	Fixed	Comp
R627	330	1/4W	5%	Fixed	Comp
R628	1.1K	1W	5%	Fixed	Comp
R629	910	1/2W	5%	Fixed	Comp
R630	6.2K	1/4W	5%	Fixed	Comp
R701	56	1/4W	5%	Fixed	Comp
R702	10K	1/4W	5%	Fixed	Comp
R703	1.2K	1/4W	5%	Fixed	Comp
R704	750	1/4W	5%	Fixed	Comp
R705	240	1/4W	5%	Fixed	Comp
R706	8.2K	1/4W	5%	Fixed	Comp
R707	1.2K	1/4W	5%	Fixed	Comp
R708	820	1/4W	5%	Fixed	Comp
R709	200	1/4W	5%	Fixed	Comp
R710	6.2K	1/4W	5%	Fixed	Comp
R711	910	1/4W	5%	Fixed	Comp
R712	750	1/4W	5%	Fixed	Comp
R713	120	1/4W	5%	Fixed	Comp
R714	18	1/4W	5%	Fixed	Comp
R715	5.1K	1/4W	5%	Fixed	Comp

Resistors

R716	680	1/4W	5%	Fixed	Comp
R717	560	1/4W	5%	Fixed	Comp
R718	68	1/4W	5%	Fixed	Comp
R719	1.8K	1/4W	5%	Fixed	Comp
R720	820	1/4W	5%	Fixed	Comp
R721	560	2W	5%	Fixed	Comp
R722	100	1/2W	5%	Fixed	Comp
R723	36	1/4W	5%	Fixed	Comp
R724	820	1/4W	5%	Fixed	Comp
R725	1.8K	1/4W	5%	Fixed	Comp
R726	560	2W	5%	Fixed	Comp
R727	100	1/2W	5%	Fixed	Comp
R728	750	1/4W	5%	Fixed	Comp
R729	270	1/4W	5%	Fixed	Comp
R730	130	1/4W	5%	Fixed	Comp
R731	820	1/4W	5%	Fixed	Comp
R732	150	2W	5%	Fixed	Comp
R733	150	2W	5%	Fixed	Comp
R734	110	1/4W	5%	Fixed	Comp
R735	300	1/4W	5%	Fixed	Comp
R736	82	1/4W	5%	Fixed	Comp
R737	49.9	1/8W	1%	Fixed	Film
R738					
R739					
R740					
R741					
R742	150	1/4W	5%	Fixed	Comp
R743	36	1/4W	5%	Fixed	Comp
R744	150	1/4W	5%	Fixed	Comp
R746	33	1/4W	5%	Fixed	Comp
R748	130	1/4W	5%	Fixed	Comp
R801	160K	1/4W	5%	Fixed	Comp
R802	270K	1/4W	5%	Fixed	Comp
R803	620K	1/4W	5%	Fixed	Comp
R804	3.3K	1/4W	5%	Fixed	Comp
R805	3.3K	1/4W	5%	Fixed	Comp
R806	8.2K	1W	5%	Fixed	Comp
R807	10K	1/4W	5%	Fixed	Comp
R808	270	1/4W	5%	Fixed	Comp
R809	20K	1/8W	1%	Fixed	Film
R810					
R811	10K			Var	WW
R812					
R813					

* Factory selected value

9/69

Resistors

R814	10K	1/4W	1%	Fixed	Film
R815	10K	1/4W	1%	Fixed	Film
R816	240K	1/4W	5%	Fixed	Comp
R817	A thru J	Factory Selected Values			
R818	1K	1/8W	1%	Fixed	Film
R819	66.5	1/8W	1%	Fixed	Film
R820	80.6	1/8W	1%	Fixed	Film
R821	97.6	1/8W	1%	Fixed	Film
R822	93.1	1/8W	1%	Fixed	Film
R823	75.0	1/8W	1%	Fixed	Film
R824	54.9	1/8W	1%	Fixed	Film
R825	43.2	1/8W	1%	Fixed	Film
R826	34.8	1/8W	1%	Fixed	Film
R827	37.4	1/8W	1%	Fixed	Film
R828	48.7	1/8W	1%	Fixed	Film
R843	1K*	1/4W	5%	Fixed	Comp
R845	560	1/4W	5%	Fixed	Comp
R846	1.43K	1/8W	1%	Fixed	Film
R847	604K	1/8W	1%	Fixed	Film

Capacitors

C601	1000pf	500V	feed thru	Fixed	Ceram
C602	.01μf	500V	20%	Fixed	Ceram
C603	1000pf	500V	feed thru	Fixed	Ceram
C604	1000pf	500V	feed thru	Fixed	Ceram
C605	1000pf	500V	feed thru	Fixed	Ceram
C606	1000pf	500V	feed thru	Fixed	Ceram
C607	1000pf	500V	feed thru	Fixed	Ceram
C608	1000pf	500V	feed thru	Fixed	Ceram
C609	1000pf	500V	feed thru	Fixed	Ceram
C610	27pf	500V	5%	Fixed	Mica
C611	470pf	500V	feed thru	Fixed	Ceram
C612	.0047μf	500V	20%	Fixed	Ceram
C613	.001μf	1KV	10%	Fixed	Ceram
C614	100pf*	500V	5%	Fixed	Mica
C615	100pf*	500V	5%	Fixed	Mica
C616	.0027μf	600V	10%	Fixed	Mylar
C617					
C618	470pf	500V	5%	Fixed	Mica
C619	.0027μf	600V	10%	Fixed	Mylar
C620	470pf	500V	5%	Fixed	Mica
C621	470pf	500V	feed thru	Fixed	Ceram
C622	.68pf	500V	5%	Fixed	Ti02
C623	32μf	64V		Fixed	Lytic

Resistors

R848	51K*	1/4W	5%	Fixed	Comp
R849					
R850	4.99	1/8W	1%	Fixed	Film
R851	14.7K	1/8W	1%	Fixed	Film
R852	37.4K	1/8W	1%	Fixed	Film
R853	10K			Var	WW
R854	20K	1/8W	1%	Fixed	Film
R855	9.76K	1/8W	1%	Fixed	Film
R856	20K	1/4W	5%	Fixed	Comp
R857	20K	1/4W	5%	Fixed	Comp
R861	2K	1/2W	5%	Fixed	Comp
R862	2K	1/2W	5%	Fixed	Comp
R863	330	1/2W	5%	Fixed	Comp
R864	110	1/4W	5%	Fixed	Comp
R865	62	1/4W	5%	Fixed	Comp
R866	110	1/4W	5%	Fixed	Comp
R867	1K	1/4W	5%	Fixed	Comp

Capacitors

C624	.1μf	500V	20%	Fixed	Ceram
C625	.047μf	400V	10%	Fixed	Mylar
C701	15pf	500V	5%	Fixed	Mica
C702					
C704	1000pf	500V	feed thru	Fixed	Ceram
C705	22pf	500V	5%	Fixed	Mica
C706	100pf	500V	5%	Fixed	Mica
C707					
C708	1000pf	500V	feed thru	Fixed	Ceram
C709	5pf	500V	5%	Fixed	Mica
C710	100pf	500V	5%	Fixed	Mica
C711	1000pf	500V	feed thru	Fixed	Ceram
C712	15pf	500V	5%	Fixed	Mica
C713	27pf	500V	5%	Fixed	Mica
C714	100pf	500V	5%	Fixed	Mica
C715	1000pf	500V	feed thru	Fixed	Ceram
C716	7pf	500V	5%	Fixed	Mica
C717	100pf	500V	5%	Fixed	Mica
C718	1000pf	500V	feed thru	Fixed	Ceram
C719	10pf	500V	5%	Fixed	Mica
C720	15pf	500V	5%	Fixed	Mica

*Factory selected value

Capacitors

C721	100pf	500V	5%	Fixed	Mica
C722	1000pf	500V	feed thru	Fixed	Ceram
C723	1000pf	500V	feed thru	Fixed	Ceram
C724					
C725	5pf	500V	5%	Fixed	Mica
C726	.001μf	1KV	10%	Fixed	Ceram
C727	3.3pf	500V	5%	Fixed	Ti02
C728	1000pf	500V	feed thru	Fixed	Ceram
C729	1000pf	500V	feed thru	Fixed	Ceram
C730	.01μf	500V	20%	Fixed	Ceram
C731	.01μf	500V	20%	Fixed	Ceram
C732	.01μf	500V	20%	Fixed	Ceram
C733	1000pf	500V	feed thru	Fixed	Ceram
C734	2.2pf	500V	5%	Fixed	Ti02
C735					
C736	1000pf	500V	feed thru	Fixed	Ceram
C737	1000pf	500V	feed thru	Fixed	Ceram
C738	1000pf	500V	feed thru	Fixed	Ceram
C739	6.8μf	35V		Fixed	Lytic
C740	6.8μf	35V		Fixed	Lytic

Transistors

Q601	2N3568	Q706	2N5109
Q602	2N5109	Q707	2N5109
Q603	2N3566		
Q604	2N3568		
Q605	2N3568		
Q701	2N3653	Q801	2N4249
Q702	2N3563	Q802	2N2405
Q703	2N3563	Q803	2N4045
Q704	2N3563	Q804	2N3565
Q705	2N5109	Q861	

Diodes

CR601	HPA3001	CR701	PD0831
CR602	HPA3001	CR801 A thru J	1N4466
CR603	1N4446	CR802	1N4446
CR604	1N4446	CR803	1N4446

Inductors

L601	Wiltron No. 6108/C
L602	Wiltron No. 6108/B
L603	Wiltron No. 6108/A
L701	Wiltron No. 6108/A
L702	.33μh
L703	Wiltron No. 6108/F
L704	10μh
L705	.33μh
L706	Wiltron No. 6108/D

Capacitors

C741	6.8μf	35V		Fixed	Lytic
C742	1000pf	500V	feed thru	Fixed	Ceram
C743	10pf	500V	5%	Fixed	Mica
C744	2.2pf	500V	5%	Fixed	Ti02
C745	3.3pf	500V	5%	Fixed	Ti02
C747	.68pf*	500V	5%	Fixed	Ti02
C801	390pf	500V	10%	Fixed	Mica
C802	.022μf	250V	10%	Fixed	Mylar
C803	22pf	500V	5%	Fixed	Ceram
C804	7pf	500V	5%	Fixed	Mica
C807	.001μf	500V	20%	Fixed	Ceram
C810	.001μf	500V	20%	Fixed	Ceram
C861	1000pf	500V	feed thru	Fixed	Ceram
C862	1000pf	500V	feed thru	Fixed	Ceram
C863	1000pf	500V	feed thru	Fixed	Ceram
C864	.68pf	500V	5%	Fixed	Ti02
C865	.5-3pf			Var	Ceram
C866	5pf	500V	5%	Fixed	Mica
C867	5pf	500V	5%	Fixed	Mica
C868	5pf	500V	5%	Fixed	Mica
C869	5pf	500V	5%	Fixed	Mica

Inductors

L707	10μh
L708	.33μh
L709	Wiltron No. 6108/D
L710	10μh
L711	.33μh
L712	Wiltron No. 6108/F
L713	10μh
L714	Wiltron No. 6108-S-847
L715	.33μh
L716	Wiltron No. 6108-S-847
L717	10μh
L718	Wiltron No. 6108-S-847
L719	10μh
L720	.33μh
L721	Wiltron No. 6108-S-847
L722	10μh
L723	.33μh
L724	Wiltron No. 6108/E
L725	Wiltron No. 6108-S-847
L861	Wiltron No. 6108-S-805
L862	Wiltron No. 6108-S-805
L863	Wiltron No. 6108/D
L864	Wiltron No. 6108/D
L865	Wiltron No. 6108/E

*Factory selected value

Transformer

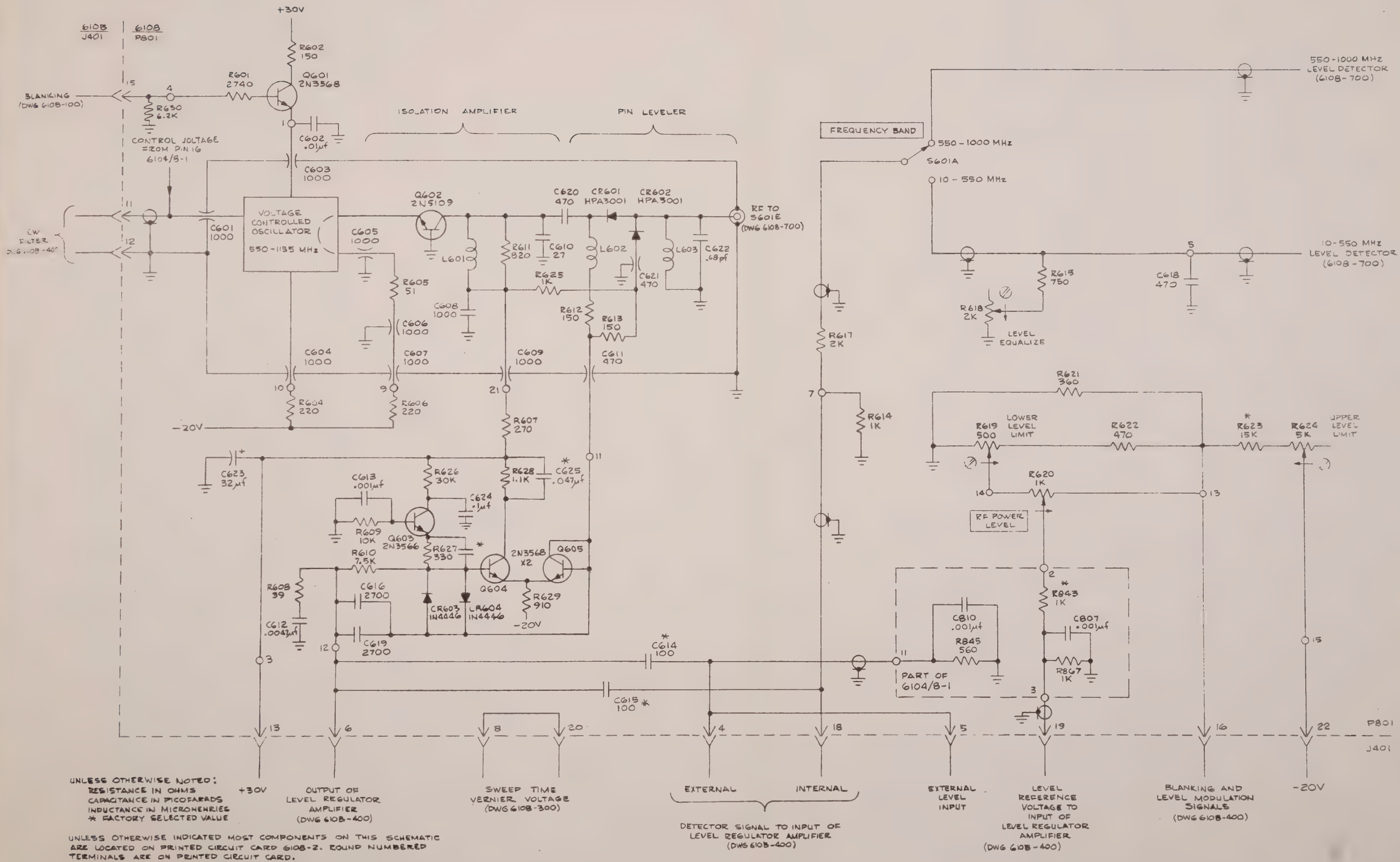
T861	Wiltron No. 6108-S-798

Miscellaneous

J801	UG-556B/U	
P801	Amphenol	26-159-24
LATCH	Southco	48-10-101-10

RF Components

550 to 1155 MHz VCO	Wiltron No. 6108-MS-246
RF Mixer Assembly	Wiltron No.
10db Coupler	Wiltron No.
High Band Detector	Wiltron No. 61D
1155 MHz LP Filter	Telonic TLP115-8AB1
1000 MHz LP Filter	Telonic TLP1000-8AB1
550 MHz LP Filter	Telonic TLP550-8AB1
10 db Pad	Texscan FP-50
S601-RF Switch	Telonic SW-20
Signal Sampler	Wiltron No. 6108-S-797
RF Cables	Wiltron No. 6108-S-804D



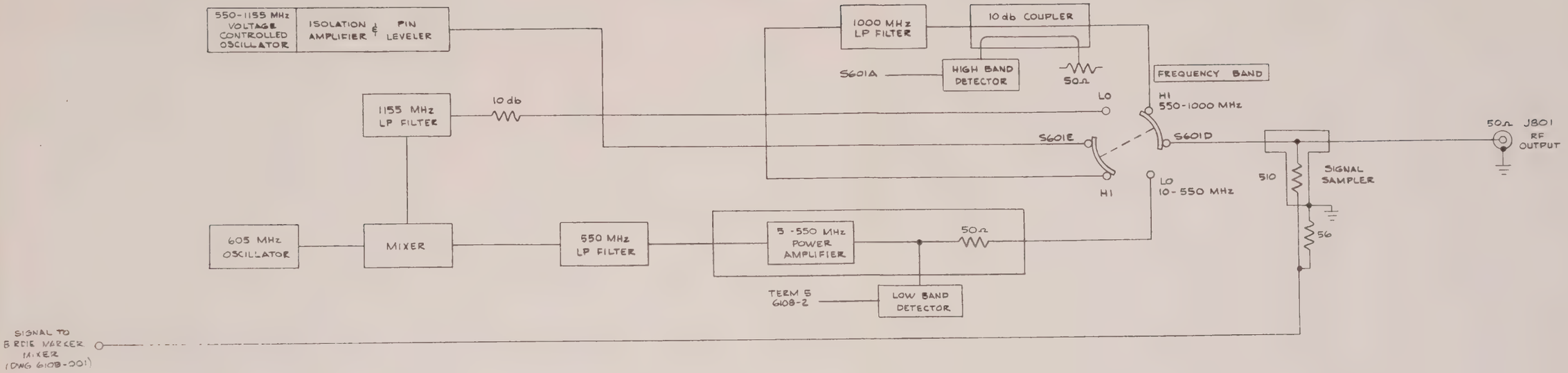
UNLESS OTHERWISE NOTED:
RESISTANCE IN OHMS
CAPACITANCE IN PICOFARADS
INDUCTANCE IN MICROHENRIES
* FACTORY SELECTED VALUE

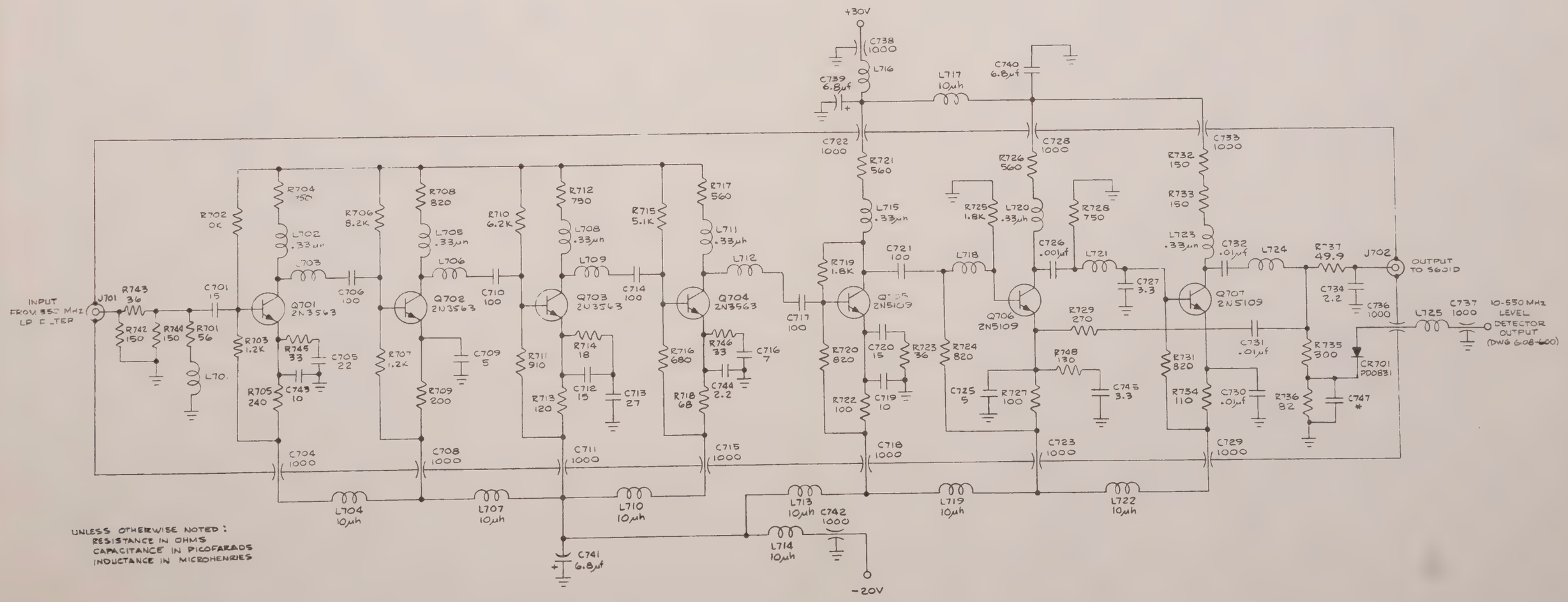
UNLESS OTHERWISE INDICATED MOST COMPONENTS ON THIS SCHEMATIC ARE LOCATED ON PRINTED CIRCUIT CARD 6108-2. ROUND NUMBERED TERMINALS ARE ON PRINTED CIRCUIT CARD.

RF GENERATOR AND LEVEL CONTROL

RF GENERATOR AND LEVEL CONTROL

RF SIGNAL DIAGRAM





UNLESS OTHERWISE NOTED:
RESISTANCE IN OHMS
CAPACITANCE IN PICOFARADS
INDUCTANCE IN MICROHENRIES

RF SIGNAL DIAGRAM AND POWER AMPLIFIER

6108-700
9-9-69

PRINT: 9-69

RF SIGNAL DIAGRAM AND POWER AMPLIFIER

+95V
HV CONTROL
J401 P801
2
14
R801 160K
+30V
12
4
R806 8.2K
FREQUENCY BAND
550-1000 MHz
10-550 MHz
S601C
R856 20K
R804 3.3K
R805 3.3K
R803 620K
R802 270K
Q801 2N4249
C801 390
Q803 2N4045
Q502 2U2405
R808 270
C802 .022μf
C803 22
R809 20K
R807 10K
-20V
16
6
VOLTAGE CONTROL TO VCO (DWG 6108-600)
J401 P801
FROM S201 (DWG 6108-200)
24
23
16
17
R850 4.99K
18
17
13
14
R847 604K
5
2
+30V
R811 10K
560 MHz ADJ
PART OF 6108-2
R814 10K
C804 7
R815 10K
R848 51K *
CR801A IN4446(X10)
B C D E F G H I J
R817A *
B* C* D* E* F* G* H* I* J*
R857 20K
10 MHz ADJ
R853 10K
R852 37.4K
19
10-550 MHz
S601B
550-1000 MHz
R854 20K
+30V
R855 9.76K
R851 14.7K
PART OF 6108-2
Q804 2N3565
R816 240K
-20V
CR802 IN4446
R818 1K
R819 66.5
R820 80.6
R821 97.6
R822 93.1
R823 75.0
R824 54.9
R825 43.2
R826 34.8
R827 37.4
R828 48.7
CR803 IN4446
R846 1430
+30V
15
7
1
-5.6V
-20V
FREQUENCY CONTROL
6108-1

+30V
C861 1000
L861
R861 2K
R862 2K
T861
C866 5
L863
L864
L865
E865 62
P861
TO MIXER (DWG 6108-700)
C862 1000
C863 1000
L862
C865 .5-3
C867 5
C868 5
C869 5
R864 110
R866 110
Q861 2N5109
R863 330
C864 .68
605 MHz OSCILLATOR

UNLESS OTHERWISE NOTED
RESISTANCE IN OHMS
CAPACITANCE IN PICOFARADS
* FACTORY SELECTED VALUE

FREQUENCY CONTROL AND 605 MHz OSCILLATOR

6108-800
8-8-69

PRINT: 9-69

FREQUENCY CONTROL AND 605 MHz OSCILLATOR

MP MASTER
MA34181